US005865918A

United States Patent [19]

Franklin et al.

[11] **Patent Number: 5,865,918**

[45] **Date of Patent: Feb. 2, 1999**

[54] **LABEL APPLICATOR**

[75] Inventors: **Richard D. Franklin**, Germantown; **Robert Franklin**, Memphis; **Robert H. McOuage**, Memphis; **Terrence D. Watson**, Memphis; **Phillip M. Williams**, Germantown, all of Tenn.

[73] Assignee: **PTI, Inc.**, Memphis, Tenn.

[21] Appl. No.: **688,652**

[22] Filed: **Jul. 30, 1996**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 328,445, Oct. 19, 1994, Pat. No. 5,540,765, which is a continuation-in-part of Ser. No. 161,686, Dec. 2, 1993, Pat. No. 5,435,862, which is a continuation of Ser. No. 772,485, Oct. 7, 1991, abandoned.

[51] **Int. Cl.**[6] **B65C 9/00**

[52] **U.S. Cl.** **156/64**; 156/363; 156/364; 156/556

[58] **Field of Search** 156/64, 285, 350, 156/362, 363, 364, 366, 382, 384, 444, 542, 556; 271/91, 94

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,729,362	4/1973	French et al.	156/542
3,769,139	10/1973	Woods	156/358
4,025,382	5/1977	Del Rosso	156/497
4,046,613	9/1977	Kucheck et al.	156/366 X
4,089,725	5/1978	Crankshaw et al.	156/299
4,210,484	7/1980	Crankshaw et al.	156/285
4,367,118	1/1983	Karp	156/497
4,468,274	8/1984	Adachi	156/320
4,561,921	12/1985	Treiber	156/297
4,595,447	6/1996	Lindstrom	156/364
4,676,859	6/1987	Cleary, Jr. et al.	156/361
4,787,953	11/1988	Trouteaud et al.	156/364
4,844,771	7/1989	Crankshaw et al.	156/387
4,895,614	1/1990	Trouteaud et al.	156/542
5,078,816	1/1992	Ratermann	156/64
5,300,160	4/1994	Wilson et al.	156/64
5,370,754	12/1994	Soloman	156/64
5,425,823	6/1995	Woodside, III	156/64

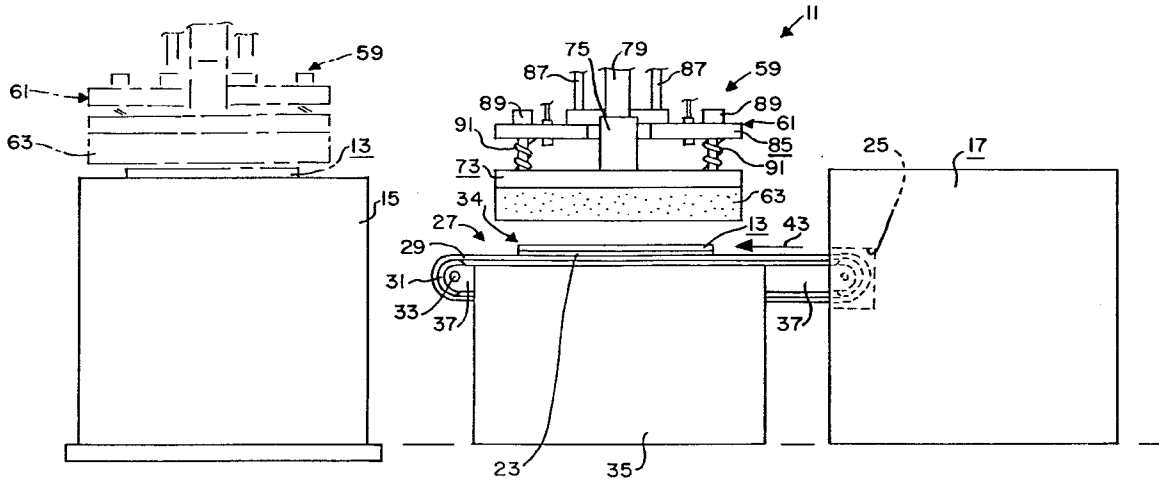
Primary Examiner—James Engel

Attorney, Agent, or Firm—Garvey, Smith, Nehrbass, & Doody, L.L.C

[57] **ABSTRACT**

A label applicator for applying a label to an article. The label includes a first side having printed matter visible thereon and a second side having a pressure sensitive adhesive thereon. The label applicator includes plasma coated tray that defines a label support structure for supporting the label with the second side of the label resting on the label support structure. A label transfer pad structure is provided with an array of openings thereon that have a vacuum source communicating therewith for gripping the first side of the label, picking up the label from the plasma coated tray, and for pressing the label onto the article. The plasma coated tray gives a non-stick surface that will not readily retain the adhesive side of the label. The label transfer pad has a suction cup portion for insuring complete separation of the label and any release liner. The label transfer pad has blow-off openings connected to a source of pressurized air for aiding in a complete attachment of the label to even irregularly shaped articles (e.g., cylinders and other non-planar surfaces).

25 Claims, 9 Drawing Sheets



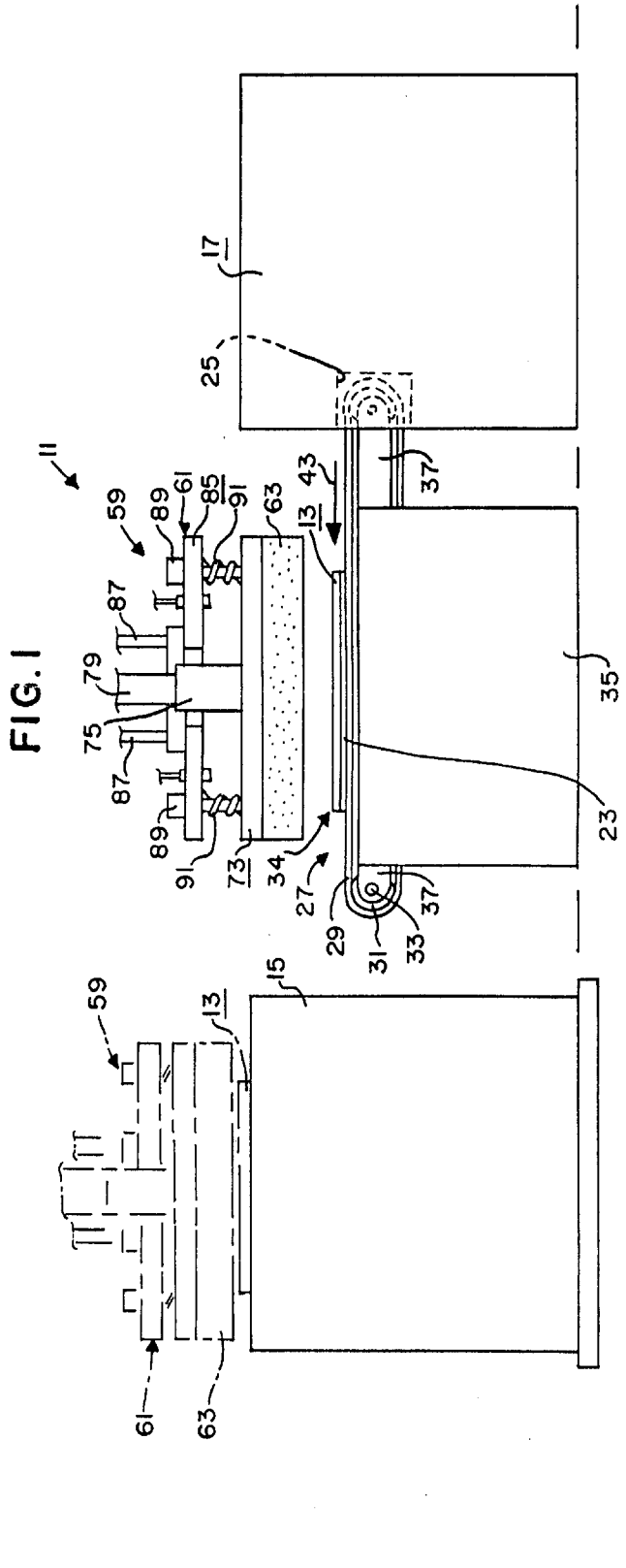

11
17
25
59
61
89
85
91
63
13
43
37
87
79
75
87
89
91
73
34
27
29
31
33
37
35
23
15
59
13
61
63

FIG. 1

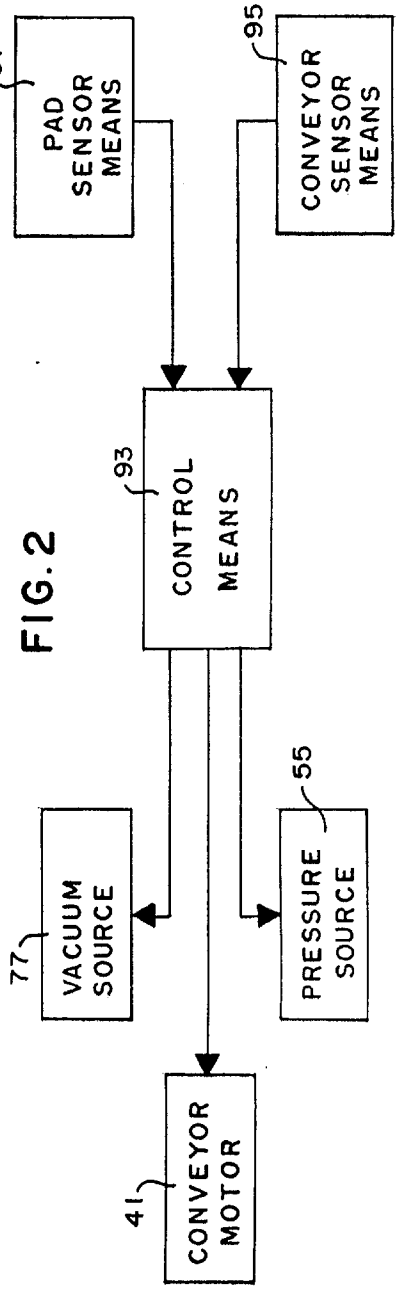

97
PAD SENSOR MEANS
95
CONVEYOR SENSOR MEANS
93
CONTROL MEANS
77
VACUUM SOURCE
55
PRESSURE SOURCE
41
CONVEYOR MOTOR

FIG. 2

FIG. 3

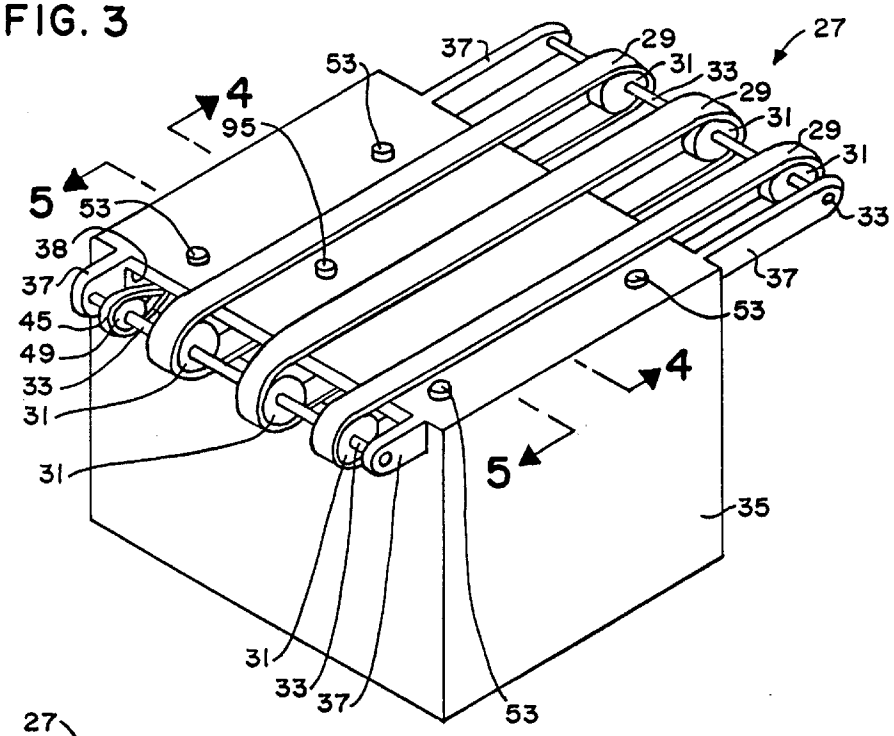


FIG. 4

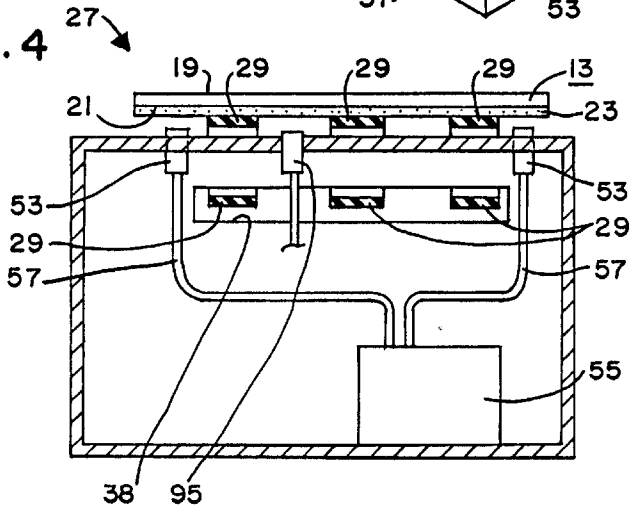


FIG. 5

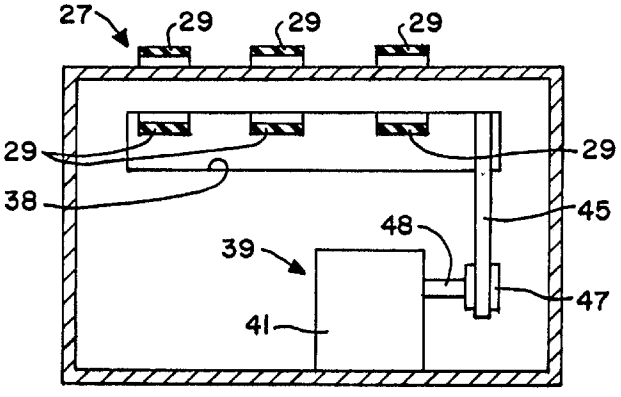


FIG. 6

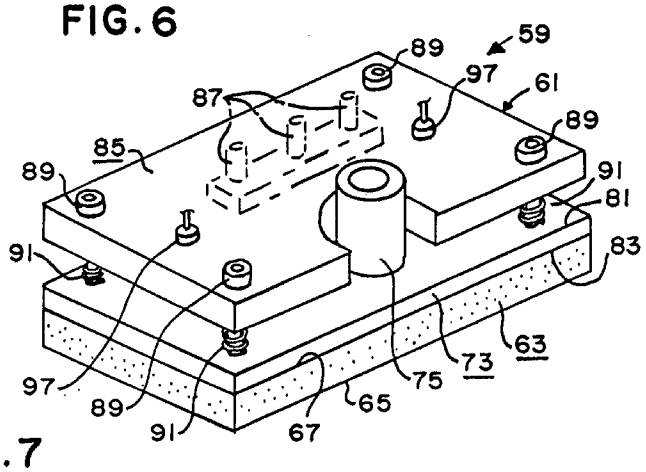


FIG. 7

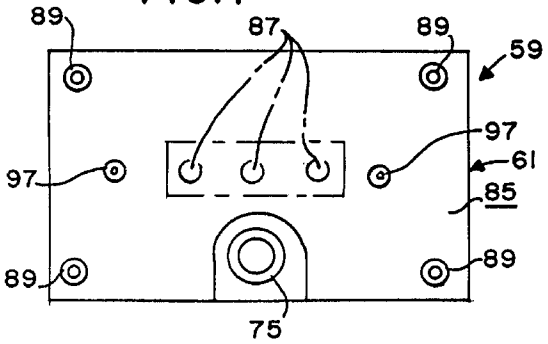


FIG. 9

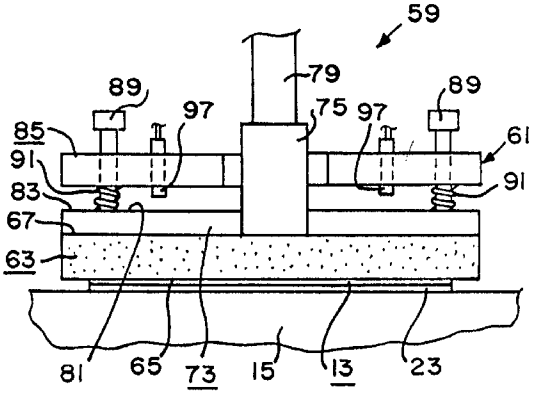


FIG. 8

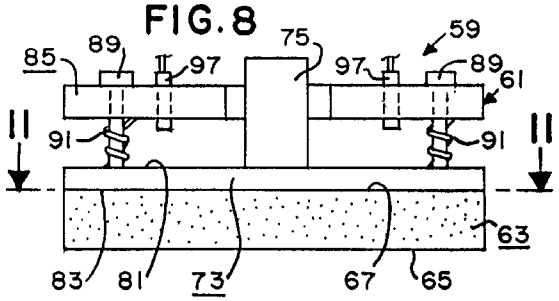


FIG. 10

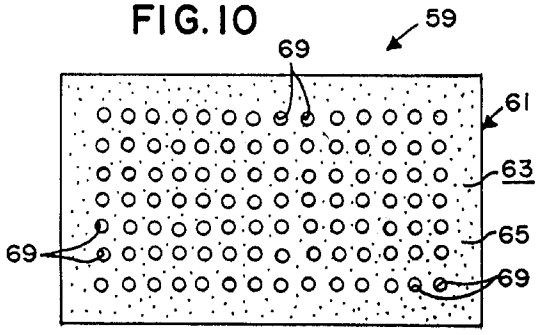
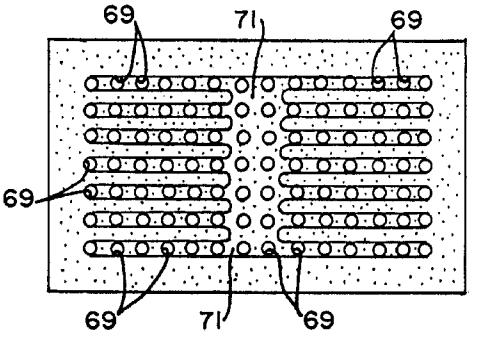


FIG. 11



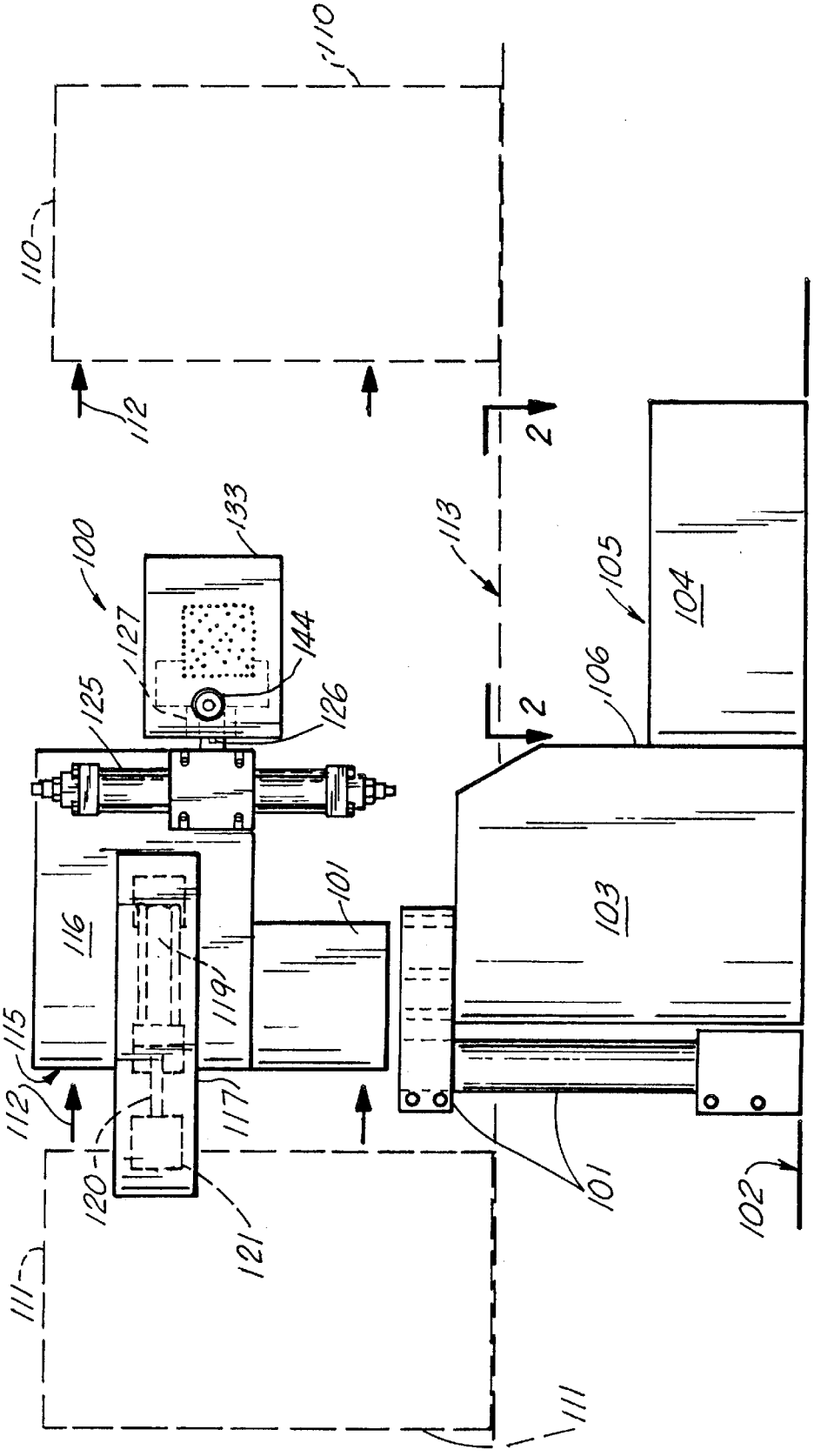

110
110
112
2
2
113
100
133
127
144
125
126
105
104
106
103
101
116
119
115
112
117
120
121
101
102
111
111

FIG. 12

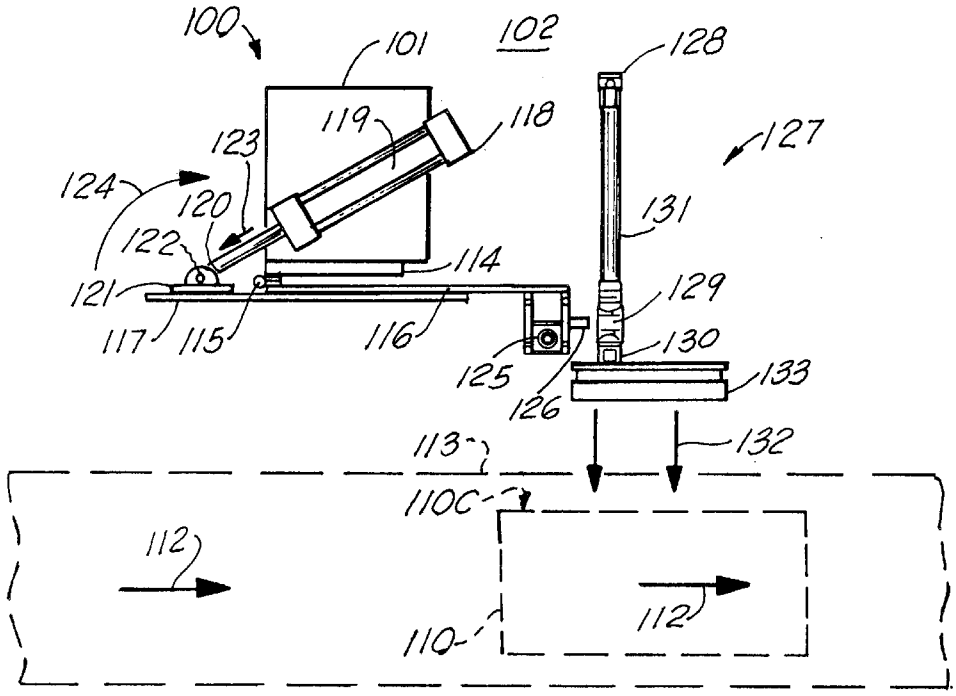


FIG. 13

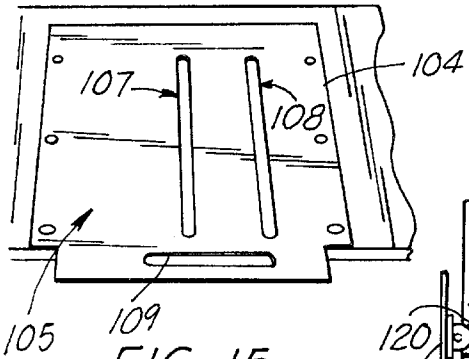


FIG. 15

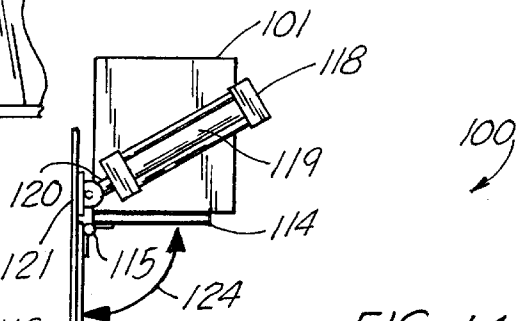
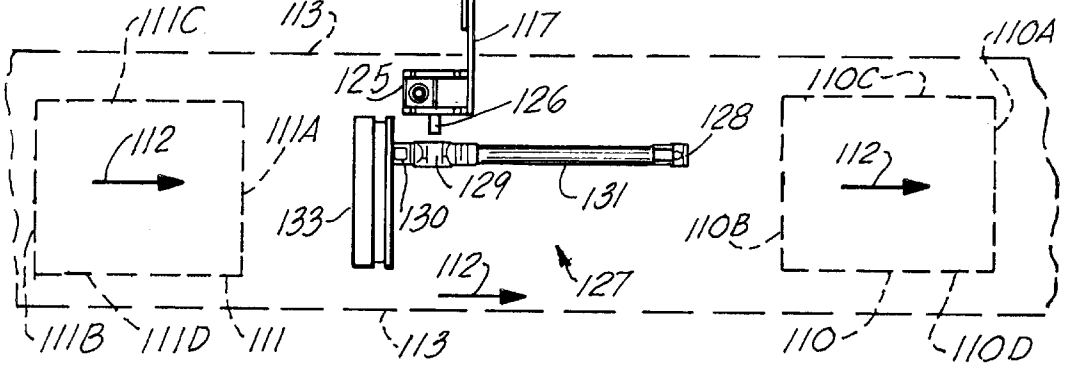


FIG. 14



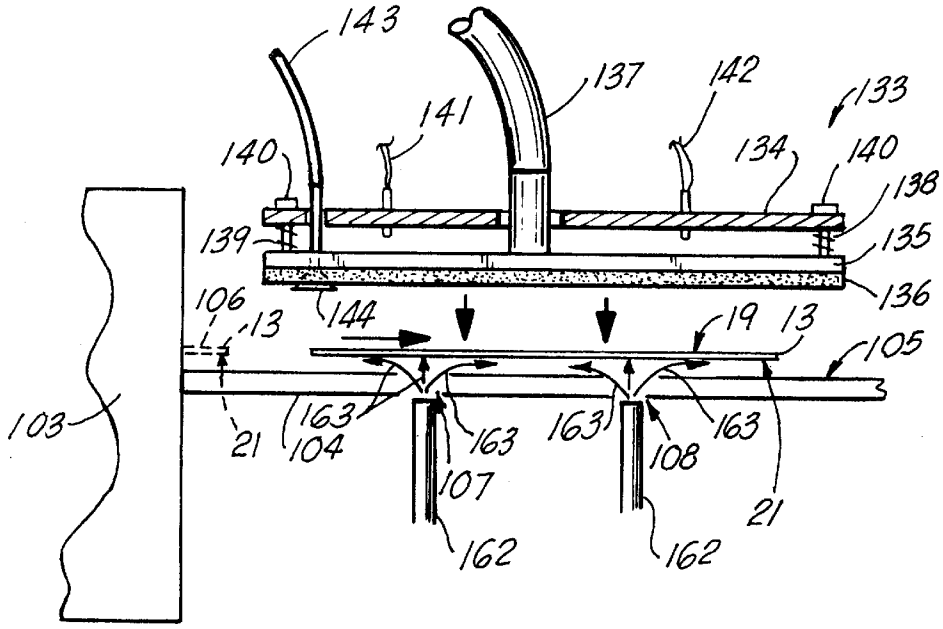


FIG. 16

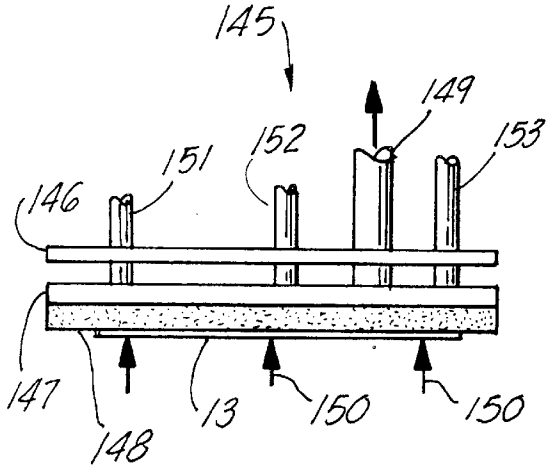


FIG. 17

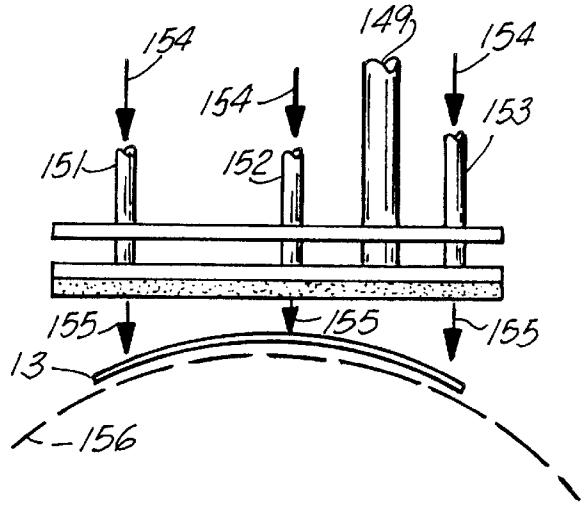


FIG. 18

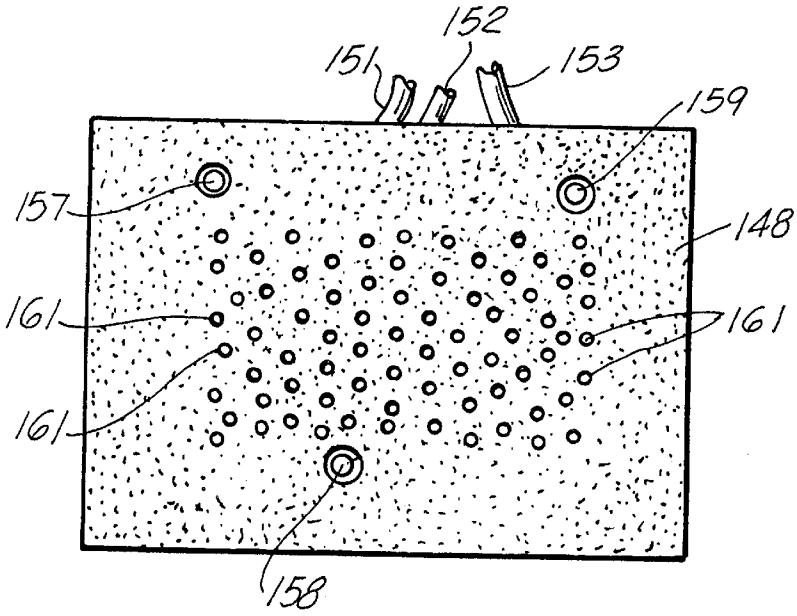

152
151
153
159
157
148
161
161
161
158

FIG. 19

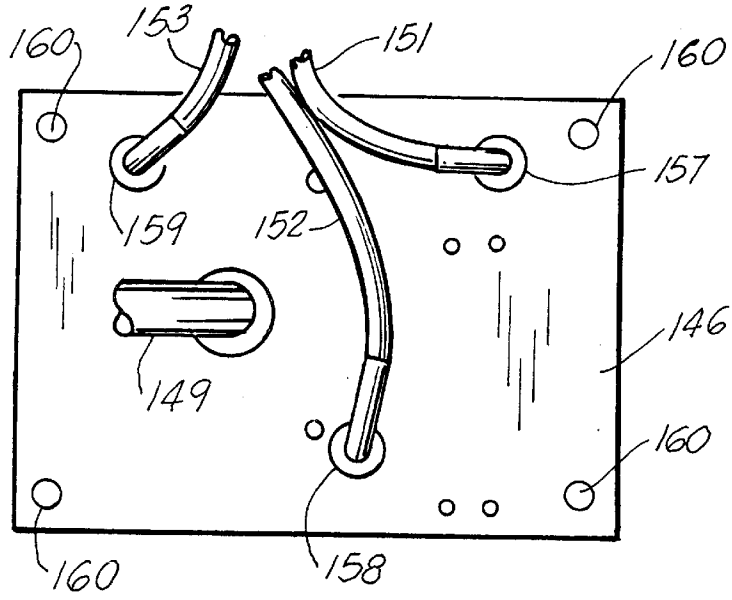

160
153
151
160
157
159
152
146
149
160
160
158

FIG. 20

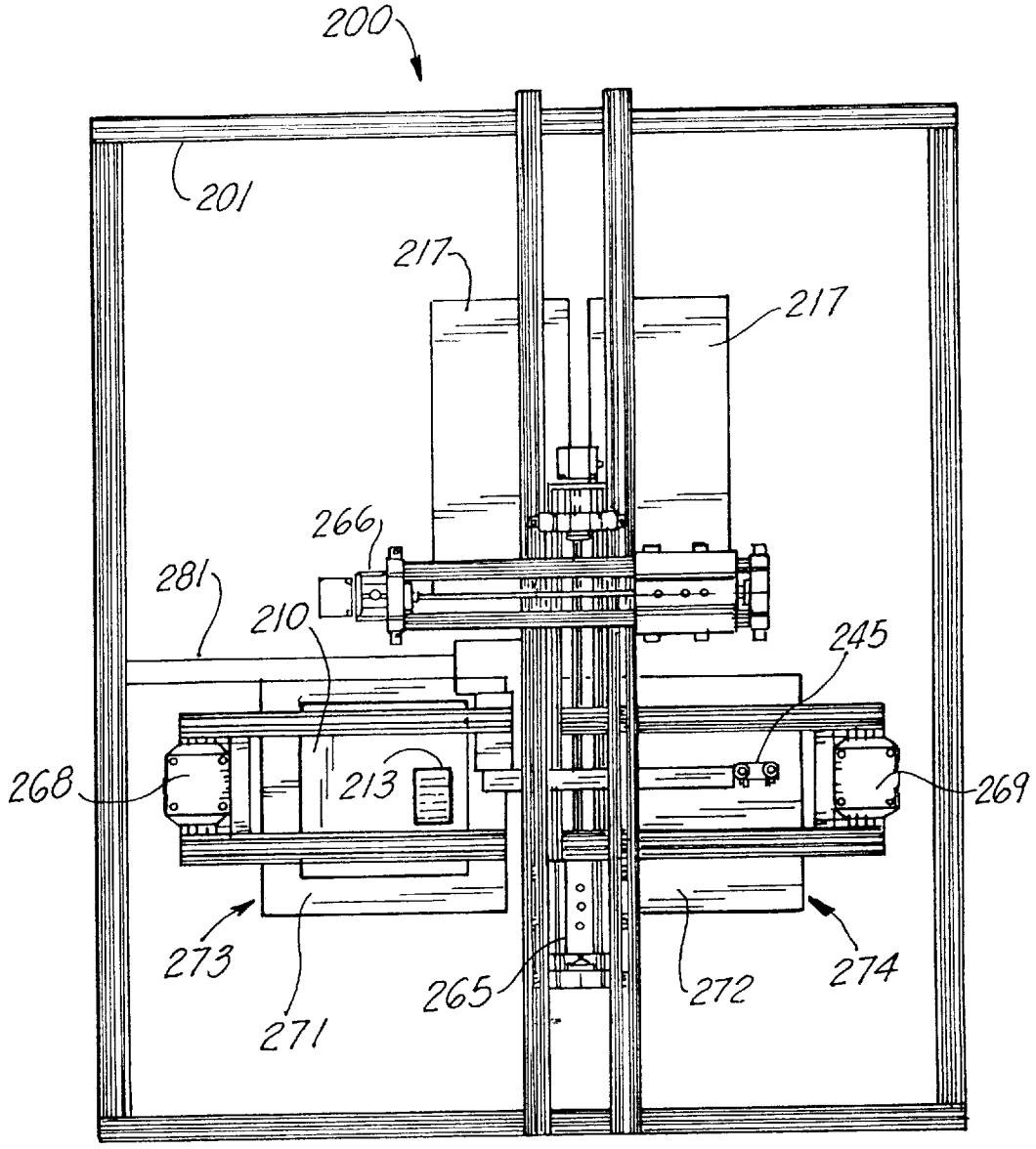
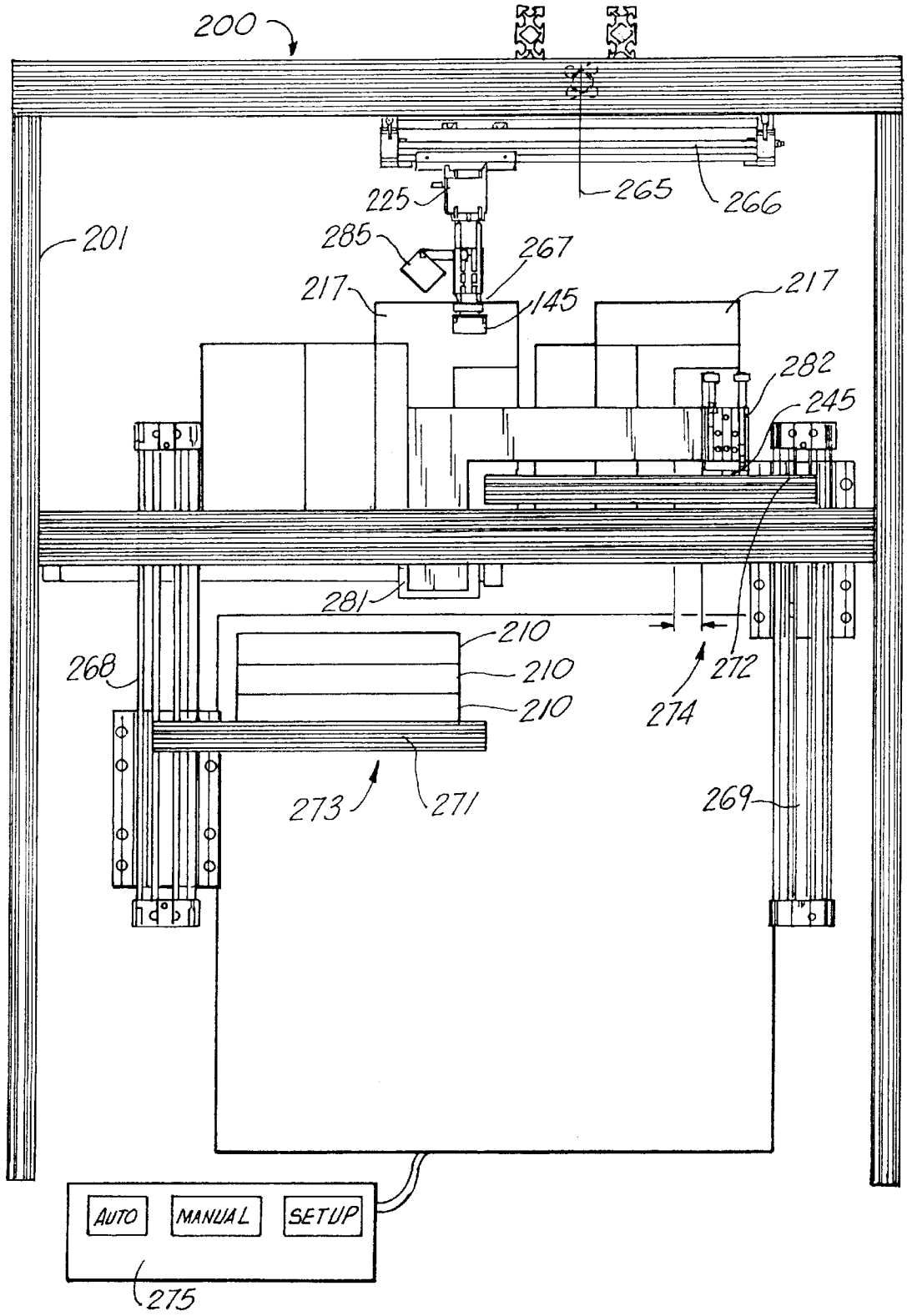


FIG. 21

FIG. 22


200
201
225
265
266
285
267
217
145
217
282
245
281
210
210
210
268
272
274
273
271
269
AUTO
MANUAL
SETUP
275

LABEL APPLICATOR

SPECIFICATION

Cross Reference to Related Applications

This is a continuation-in-part of U.S. patent application Ser. No. 08/328,445, filed Oct. 25, 1994, now U.S. Pat. No. 5,540,795, which is a continuation-in-part of U.S. patent application Ser. No. 08/161,686, filed Dec. 2, 1993, now U.S. Pat. No. 5,435,862, which is a continuation of Ser. No. 07/772,485, filed Oct. 7, 1991, now abandoned, all of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates, in general, to apparatuses for printing pressure sensitive labels and attaching the printed labels to articles.

2. General Background

There are numerous products with packaging having printed label material that is affixed to the product after its manufacture. One example is a bar code label that can contain price information, inventory control and the like. While many products contain such labels on the package as manufactured, there are certain products that receive adhesive labels after manufacture. One example of such a product is a palletized shipping container. Shipping containers are frequently constructed of an underlying pallet that contains numerous boxes or bags of product for shipment to the end user. These products are held to the pallet by a cardboard upper or by shrink wrap plastic film for cost and inventory purposes; it is desirable to place labels on these palletized products as they are conveyed along a moving conveyor in the factory. Other containers that require bar code or like labelling include generic cardboard boxes and cylindrical cans as examples.

Many of these types of products are bulky and have required labor intensive manual application of labels thereto at great expense. Further, many of these packages are stacked and stored in warehouses so that the orientation of the package frequently hides labels that have information needed for pricing, inventory and the like. Therefore, in many instances it is important to affix multiple labels to a package such as for example on a front or rear surface of the package and/or on either side of the package.

Several patents have issued which relate generally to the application of adhesive labels to articles. As an example, French, U.S. Pat. No. 3,729,362 issued Apr. 24, 1973, discloses a labeling machine including a supply reel and a take up reel. Labels are adhesively secured to a backing strip and the backing strip is wound on the supply reel. The backing strip and labels are moved from the supply reel toward the take up reel and the labels are peeled off of the backing strip and momentarily retained at a first station. An applicator transfers the label to an adjacent article.

U.S. Pat. No. 3,769,139, issued Oct. 30, 1973 to Woods discloses a labeler in which labels, coated with pressure sensitive adhesive and carried by a web of release paper having formed therein feed sprocket holes, are drawn along a predetermined path through a print station and about a sharp reverse bend by a feed drum having disposed about the periphery thereof drive pins spaced to correspond to the spacing of the feed sprocket holes in the web of release paper. The feed drum is in turn driven by a solenoid actuated ratchet feed and may be readily replaced by other feed drums having drive pins spaced to correspond with the feed holes on webs of other sizes of labels. As the release paper is drawn about the sharp reverse bend, the label projects outwardly and a hammer, solenoid actuated in timed relationship with the label feed, is driven against the label to slap the label against an article.

The Del Rosso U.S. Pat. No. 4,025,382 discloses an apparatus for applying a label to an article while the article is being transported along a path of travel by a conveyor. The apparatus includes a vertically movable applicator foot operable to pick up a label from a source and apply such label to the surface of an article, and a vertically movable compressor foot operable to engage the applied label to cause it to conform to the contour of the article surface. The applicator foot and compressor foot are independently supported for conjunctive movements with the article in the direction of conveyor travel, while operably engaged therewith.

U.S. Pat. No. 4,089,725, issued to Crankshaw discloses an apparatus for transferring labels to articles which are moved in a first direction through a station. The apparatus releasably retains first and second labels at first and second positions with the positions defining a row at the station. The axis of the row extends generally in the first direction and the first position being downstream in the direction of article movement of the second position. The first and second labels are transferred to first and second articles, respectively, as the first and second articles are moved through the station.

The Crankshaw U.S. Pat. No. 4,210,484 discloses a label applicator adapted for use with labels which are provided in a plurality of rows extending longitudinally on a backing strip. The label applicator includes a label dispenser for peeling the labels from the backing strip with the labels moving in a first direction off of the backing strip to provide at least first and second labels at a label dispensing station. A label separator receives the first and second labels and separates them in a direction generally transverse to the first direction to increase the distance between the first and second labels. The separated labels are then transferred to at least one article.

U.S. Pat. No. 4,255,220, issued to Kucheck discloses a label applicator including a label receiver mounted on supporting structure for movement between a retracted position and an extended position. A label dispenser supplies a label to the label receiver when the label receiver is in the retracted position. The label is releasably retained on the label receiver. The label receiver is then moved to the extended position where the label is transferred by an air blast from the label receiver to an article.

U.S. Pat. No. 4,367,118, issued to Karp, discloses a label applicator for seizing a printed, adhesive-backed label and for applying the label to a commodity. The applicator includes a pick-up head for vacuum-seizing a portion of the label by its non-adhesive side and for swinging the label to a label transfer station. At the latter station, the pick-up head releases its grip on the label and an applicator head vacuum-seizes another portion of the non-adhesive side of the label and then applies the label to the commodity.

The Treiber U.S. Pat. No. 4,561,921, discloses a label applicator device that receives a label from a label printer and applies the label to a package by means of pressure-sensitive adhesive which coats one side of the label. The applicator device includes a label support means which receives a label with the adhesive coated side facing upward. The label support means includes pair of fingers upon which the label rests. A label transfer nozzle is pivoted about a horizontal axis beneath the label support means into a first position in which it is received between the pair of fingers

and engages the printed side of the label by means of a partial vacuum supplied through a vacuum port in the transfer nozzle. The transfer nozzle is then pivoted into a second position in which the adhesive coated side of the label is facing generally downward. The applicator device includes an applicator head which moves downward, removing the label from the transfer nozzle and pressing it into contact with the surface of a package.

The Linstrom U.S. Pat. No. 4,595,447 discloses an article labeling machine including a bell-shaped vacuum foot that subtends from a vertically extending tube to receive a printed label in a first orientation from the label dispenser which is located to one side of and at a higher elevation than a conveyor which is transporting articles to be labeled. The label-carrying vacuum foot is moved laterally away from the dispenser through a downwardly smoothly curving diagonal path devoid of any abrupt directional changes. If required, the tube is simultaneously operated to rotate the label into a preselected second orientation as it is being lowered upon the article to be labeled.

The Trouteaud U.S. Pat. Nos. 4,787,953, 4,895,614 disclose label transfer apparatus including a label transfer arm having a central axis and comprising a socket body with a transfer nozzle rotatably mounted therein for engaging labels delivered to a label pickup station and for transferring them to a label delivery station. An applicator head strips the labels from the transfer arm and moves them along a fixed path from the label delivery station to a package labeling station to apply the labels to packages. Transfer arm guiding rails are positioned on either side of the label transfer arm for engaging an eccentric collar attached to the transfer nozzle to thereby orient the transfer nozzle into a fixed angular orientation about the central axis of the transfer arm when the transfer arm is at the label delivery station. An operator-controllable selector ring is rotatably mounted to the socket body of the arm and is freely rotatable between selected locations defined by detents. By selecting the angular orientation of the arm at the label pickup station and forcing the arm into a fixed angular orientation at the label delivery station, a label held by the transfer arm is rotated about the central axis of the arm by an angle equal to the difference between the selected angular orientation and the fixed angular orientation.

The Crankshaw U.S. Pat. No. 4,884,771 discloses a label applicator including a support structure in predetermined relationship with a labeling station at which to apply a label to an article. A label dispenser mounted on the support structure dispenses a label to be applied to the article and a receiver movably mounted on the support structure transports the label from the dispenser to the labeling station. Receiver-mounting components are provided for mounting the receiver on the support structure both to enable generally linear movement of the receiver along a path between a retracted position adjacent the dispenser and an extended position adjacent the labeling station, and to enable pivotal movement of the receiver about a pivot axis between a label-receiving position in which the label receiver can receive a label from the dispenser and a label-applying position in which the label can be transferred from the label receiver to a face of an article at the labeling station. Label retaining components releasably retain the label on the receiver so that the label can be transported by the receiver to the labeling station for application to the face of the article.

SUMMARY OF THE INVENTION

The present invention is provide an improved label applicator for receiving and for applying a printed, adhesive backs label to an article. The applicator of the present invention is for use with labels that include a first side having printed matter visible thereon and including a second side having a pressure sensitive adhesive thereon.

The label applicator of the present invention includes, a label support or tray for supporting the label after receiving same from the label printer. The adhesive side of the label rests on the label support.

A label pickup pad picks up the label from the label support or tray and presses the label to a selected side of the box, container, package, or like article.

One object of the present invention is to provide a label applicator that will engage and hold a pressure-sensitive label at the non-adhesive printed side after the label has been discharged from the output port of a label printer, even after any backing or release liner has been stripped from the sticky adhesive side of the label.

Other features of the present invention include the use of a tray that has an adhesive resistant coating thereon so that the label can be placed on the tray with the adhesive side down and without an aggressive connection being formed between the adhesive and the tray. In the preferred embodiment, the tray is provided with a nickel chrome "plasma" coating that can be applied to the aluminum plate that forms the tray. Such coatings are available from Plasma Coatings, Inc. of Waterbury, Conn. and Memphis, Tenn.

The label pickup pad can be optionally supplied with a feature for aiding in the separation of the label from the pad when the label is to be applied to an irregularly shaped article or a non-planar surface of an article, such as for example, an article with a curved side, for example a cylinder.

In one embodiment, the present invention provides a "flapper" arrangement that includes a pivot hinge for joining a moving plate to the machine frame. The moving plate "flaps" between first and second positions that are for example about ninety degrees (90°) apart. A pneumatic actuator cylinder is used to pivot the moving plate relative to the machine frame. The moving plate supports the label applicator pad using a pneumatic rotary actuator (for rotating the pad between vertical and horizontal positions) and a pneumatic slide actuator (for extending and retracting the pad).

In one embodiment, the pad is provided with a vacuum cup at one end portion for ensuring complete separation from the label and a release liner. This vacuum cup is in addition to an array of vacuum openings spaced over the pad's surface. The vacuum cup can be used for very large labels or for labels that have a very aggressive adhesive. Thus, the vacuum cup can be positioned adjacent the output port of a conventional printer that generates printed labels having a rear adhesive surface and a release liner or backing.

The plasma coated tray can optionally be equipped with a source of air, preferably mounted under the tray for discharging air through slots in the tray to the upper surface of the tray. This source of air forms a "air float" under the labels to assist in preventing aggressive connection between the adhesive backing of the label and the plasma coated tray. Understandably, the flow rate of air through the slots and to the underside of the label is controlled so that a simple interface of air is formed between the label and the tray and not such a great quantity of air flow that the label is undesirably moved away from the tray prior to the time that it is picked up by the label applicator pad.

These objects and advantages of the present invention are accomplished more specifically by providing an apparatus

for transferring a series of labels, each having opposing adhesive and printed sides to each of a plurality of articles being conveyed along a conveyor path on a moving conveyor belt, for example. The articles can includes cardboard boxes, box-like packages, cylindrical objects such as paint cans, pallets of bulky materials (such as dog food) stacked six packs of drinks, stacked cans of cleaning solution, and the like. Such palletized containers are commonly used by manufacturers to convey a host of products to the market place, each of these palletized containers being easily transportable within factories, between trucks and loading docks, etc. using a variety of forklifts. The present invention can be used to apply labels in sequence to such products notwithstanding the size or configuration of the package.

The apparatus of the present invention includes a printer for printing in sequence a plurality of pressure sensitive adhesive labels. Each label has an adhesive side and a printed side with printed matter thereon (for example bar code information) and each of the labels provides a release liner backing on the adhesive side. The printer preferably includes means for stripping the backing from the labels as they are printed. An output port on the printer discharges the label in sequence as each label has been printed and after its backing has been stripped. A label transfer surface holds each label after it is discharged from the printer. The label transfer surface is preferably covered with a coating such as a plasma coating that allows the label to contact the plate but without substantial adhesion thereto; with the present invention the adhesive side of the label faces the label transfer surface.

A label pickup pad is movably mounted with respect to a machine frame. The pickup pad includes a pad surface for engaging and lifting the label free from contact with the pickup point of the transfer surface. Thus, the label pickup pad makes contact with the printed side of the label. In order to securely hold the label to the pad, a vacuum source is supplied to the pad surface, the vacuum being preferably activated with a controller after the pickup pad is properly positioned to receive a label from the label transfer surface.

The label holding pad is movably supported by the frame between the pickup point and the articles, and in sequential fashion as the articles are conveyed along the conveyor path.

A controller can be used to control the timing of the transfer of labels from the printer to the pickup point, and for controlling the time of travel of the pad between the pickup point and each of the conveyed articles.

The present invention can move the label holding pad into multiple planes, including for example a horizontal plane when engaging a label from the label transfer surface and vertical planes when applying the label to the side of an article.

A feature of the present invention is that the label holding pad can apply labels to the side of a box being transferred or to the front or rear of a box being transferred, using the "flapper" to rotate the pad ninety degrees (90°) depending upon the surface to be engaged with the label. Thus, the present invention provides a system that can apply multiple labels to packages or boxes including the side and front, or the side and back of a box or article.

The pickup pad includes a pad member that comprises a pair of spaced apart mounting plates. The mounting plates are movable relative to one another between extended and retracted positions.

The mounting plates are supported at a desired fixed known distance apart in an extended position. One of the mounting plates carries the label-holding pad, preferably a foam or like resilient pad, having holes therethrough for receiving the vacuum source.

The plurality of openings are thus spaced over the surface of the label-holding pad as the pad is sized and shaped to conform generally to the labels being transferred and applied.

Spacers hold the mounting plates apart the said fixed distance. The spacers are preferably in the form of bolt and spring telescoping connections that allow the plates to move toward one another responsive to a compression applied to one of the mounting plates such as when the label holding pad applies a label to one of the articles being conveyed. Springs hold the plates apart in the extended position. When the pad assembly engages an article with a label, the spring tension is overcome allowing the two plates to move together.

A sensor senses this movement of the two plates toward one another indicating that the label has been applied. This sensor can then be used to return the pad to the original position at the pickup point so that the next label can be secured for application to the next package or article.

The present invention thus provides an improved method of applying a printed label to each article in a stream of conveyed articles travelling on a moving conveyor along the conveyor path.

With the method of the present invention, a plurality of pressure sensitive adhesive labels are generated, each having printed matter opposite the adhesive side of the label. The labels are discharged in sequence, for example, from an output port of a printer after printing the label with the printer.

The labels are then placed on a transfer surface, preferably with the label adhesive surface facing the transfer surface and with the printed side of the label facing away from the transfer surface. The label is then picked up from the pickup point with a moving label applicator that moves between a pickup point and a label application position spaced away from the pickup point.

The label applicator has a pickup pad with a surface that is generally sized and shaped to conform to the size and shape of the label.

A source of vacuum associated with the label applicator is used to hold the printed side of the label to the label applicator pad surface. The label applicator pad is then moved to a position adjacent one of the series of articles to be labeled that is travelling on the moving conveyor. The article is then contacted with the label applicator and the adhesive side of the label by engaging the article with the pad surface. The pad then returns to the pickup point when the next label is transferred to the pickup position.

With the present invention, the label can be selectively applied to a selected side of the article, such as a front or rear surface of the article, or one of the lateral sides of the article as the article is being conveyed along a conveyed path with a stream of articles that passes adjacent the apparatus.

A fourth embodiment of the present invention includes means for varying the location of the label on the article, when the article is presented at a given location on the conveyer path.

BRIEF DESCRIPTION OF THE DRAWINGS

For a further understanding of the nature and objects of the present invention, reference should be had to the following detailed description, taken in conjunction with the accompanying drawings, in which like parts are given like reference numerals, and wherein:

FIG. **1** is a somewhat diagrammatic side elevational view of the first embodiment of the label applicator of the present invention;

FIG. **2** is a block diagram of the control means of the first embodiment of the label applicator of the present invention;

FIG. **3** is a perspective view of the label conveyor means of the first embodiment of the label applicator of the present invention;

FIG. **4** is a sectional view substantially as taken on line **4—4** of FIG. **3** with certain parts omitted for clarity and with a label shown thereon;

FIG. **5** is a sectional view substantially as taken on line **5—5** of FIG. **3** with portions thereof omitted for clarity;

FIG. **6** is a perspective view of a label grip means of the first embodiment of the label applicator of the present invention with a portion of a transfer mechanism shown in broken lines;

FIG. **7** is a top plan view of the label grip means of FIG. **6**;

FIG. **8** is a side elevational view of the label grip means of FIG. **6**.

FIG. **9** is a side elevational view of the label grip means of FIG. **6** shown applying a label to an article;

FIG. **10** is a bottom plan view of the label grip means of FIG. **6**;

FIG. **11** is a sectional view substantially as taken on line **11—11** of FIG. **8**.

FIG. **12** is an elevational view of a second embodiment of the apparatus of the present invention;

FIG. **13** is a top plan view of the second embodiment of the apparatus of the present invention showing the label applicator in the position for applying a label to the side of an article being conveyed;

FIG. **14** is a top plan view of the second embodiment of the apparatus of the present invention showing the label applicator in a position for applying the label to either the front or rear of an article being conveyed;

FIG. **15** is a sectional view taken along lines **2—2** of FIG. **12**;

FIG. **16** is a fragmentary sectional view of the second embodiment of the apparatus of the present invention illustrating the label transfer tray and label holding pad portions thereof;

FIG. **17** is a schematic sectional fragmentary view of a third embodiment of the apparatus of the present invention;

FIG. **18** is a schematic sectional fragmentary view of a third embodiment of the apparatus of the present invention;

FIG. **19** is front, elevational fragmentary view of the third embodiment of the apparatus of the present invention;

FIG. **20** is a rear, fragmentary elevational view of the third embodiment of the apparatus of the present invention;

FIG. **21** is a top, plan view showing a fourth embodiment of the present invention, including means for varying the location of the label on the article, when the article is presented at a given location on the conveyer path; and

FIG. **22** is an elevational view showing the fourth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the label applicator apparatus of the present invention is shown diagrammatically in FIG. **1** and identified by the numeral **11**. The label applicator **11** is used to apply pressure sensitive labels **13** to articles **15** and is used in combination with a typical pressure sensitive label printer **17**. Each label **13** has a first or face side **19** having printed matter visible thereon, and a second or reverse side **21** having a pressure sensitive adhesive **23** thereon (see, in general, FIG. **4**).

The label printer **17** may be a standard Intermec 86 series printer (e.g., an Intermec 8646 printer) or the like for printing the printed matter on the first side **19** of each label **13**. The label printer **17** is preferably a self-stripping model. More specifically, pressure sensitive label printers typically utilize a plurality of blank labels that are mounted on a roll or strip of release material. After a label is printed, a self-stripping printer will strip or remove the printed label from the roll or strip of release material and expel the stripped, printed label through an output port **25** or the like as will now be apparent to those skilled in the art. However, a non-self-stripping label printer could be used in combination with a separate stripping mechanism as will now be apparent to those skilled in the art.

The label applicator **11** includes a label support **27** for receiving a label **13** from the label printer **17** with the pressure sensitive adhesive **23** of the label **13** resting on the label support **27**. The label support **27** preferably includes a label support surface for allowing the label **13** to be temporarily secured thereto by the pressure sensitive adhesive **23** while allowing the label **13** to be easily removed therefrom without damage to the label **13** for subsequent application to the article **15**.

The label support **27** includes a plurality of spaced apart belts **29**. Each belt **29** is preferably an endless conveyor belt having a flat outer or support surface and trained about sheaves or pulleys **31** or the like. More specifically, the pulleys **31** are preferably supported by a pair of spaced apart axles **33** in such a manner so as to define a path of travel for the labels **13** from the output port **25** of the label printer **17** to a pickup point as indicated by the arrow **34** in FIG. **1**. Axles **33** are preferably attached to a body member **35** by ears **37** or the like. The lower bight of the belts **29** may extend through slots **38** in the opposite ends of the body member **35** with the top bight of the belts located just above the top surface of the body member **35**. The belts **29** may be adjustable in any manner now apparent to those skilled in the art to allow the tension of the belts **29** to be adjusted. At least the outer surface of the belts **29** is slick to prevent the pressure sensitive adhesive **23** of the labels **13** from forming a strong adherence thereto. More specifically, the belts **29** can be constructed from a slick plastic or the like so that the labels **13** can be removed therefrom without damage to the labels **13**.

A motor drive **39** is provided for moving the labels **13** from the output port **25** of the label printer **17** to the pickup point **34**. The drive **39** can include an electrical conveyor motor **41** coupled to the belts **29** in such a manner so as to cause the belts **29** to rotate in the direction indicated by the arrow **43** in FIG. **1**. More specifically, the motor **41** is preferably coupled to one of the axles **33** by a drive belt **45** through a first pulley **47** attached to the drive shaft **48** of the motor **41** and a second pulley **49** attached to one of the axles **33** so that rotation of the drive shaft **48** of the motor **41** will cause the belts **29** to rotate in the direction indicated by the arrow **43** to thereby cause any label **13** supported on the belts **29** to move from the output port **25** of the label printer **17** to the pickup point **34**.

The drive belt **45** may extend through one of the slots **38** in one end of the body member **35** as shown in FIG. **4**. The

speed at which the drive means **39** rotates the belts **29** is preferably substantially the same speed at which the label printer **17** discharges printed labels **13**.

The label applicator **11** preferably includes a pressure source **51** for applying pressure to the second side **21** of a label **13** supported on the belts **29** when that label **13** reaches the pickup point **34** to urge that label **13** from the label support surface means (i.e., from the belts **29**). The pressure source **51** can include air control jets **53** (e.g., a plurality of air jets or nozzles) for blowing air against the second side **21** of that label **13** adjacent the belts **29** to urge that label **13** upward from the belts **29**. The pressure source **51** preferably supplies pressurized air to the air jets or nozzles **53**. The pressure source **51** may include an electric air pump **55** or the like coupled to the air pressure jets **53** by tubing **57** or the like as will now be apparent to those skilled in the art.

The label applicator **11** includes a label transfer **59** for picking up a label **13** from the label support **27** and for applying that label **13** to the article **15**. The label transfer **59** preferably includes a label grip means **61** for gripping the label **13**. The label grip means **61** preferably includes a resilient pad member **63** having a first side **65** for engaging the first side **19** of the label **13**, and having a second side **67**.

A plurality of spaced apart apertures **69** preferably extend from the first side **65** of the pad member **63** to a manifold **71** formed by a plurality of channels which join each of the apertures **69** together to allow a vacuum to be evenly applied to each of the apertures **69**. The pad member **63** is preferably constructed of sealed foam for providing a soft touch and for isolating each aperture **69** with vacuum. Thus, by applying a vacuum to the apertures **69** through the manifold **71**, the label **13** can be picked-up and gripped by the first side **65** of the pad member **63** when the pad member **63** is placed in contact with the first side **19** of the label **13** as will now be apparent to those skilled in the art. The use of small, multiple apertures **69** keeps the label **13** from deforming when picked up by the pad member **63**. The channels of the manifold **71** insure the even flow of vacuum to all apertures **69** and allow the label **13** to be picked up evenly and straight.

The label grip **61** preferably includes a first mounting plate **73** for being attached to the second side **67** of the pad member **63**. The first mounting plate **73** is preferably constructed out of light weight aluminum and has a port **75** for being attached to a vacuum source **77** by a flexible pipe **79** or the like. The vacuum source **77** may include an electric vacuum pump, a non-mechanical pump, or the like coupled to the port **75** by the pipe **79**.

The first mounting plate **73** preferably has a first side **81** and a second side **83**. The second side **67** of the pad member **63** is preferably glued or otherwise attached to the second side **83** of the first mounting plate **73** with the manifold **71** communicating with the port **75** so that vacuum can be directed from the vacuum source **77**, through the pipe **79** and port **75** to the manifold **71** and apertures **69**.

The label grip **61** preferably includes a second mounting plate **85** for being movably attached to the first mounting plate **73** and for being attached to the actuator arms **87** or the like of a transfer mechanism of the label transfer means **59**. The second mounting plate **85** is preferably constructed out of light weight aluminum for strength and support. The first and second mounting plates **73**, **85** are preferably slidably attached to one another for allowing movement from a first or separated position as shown in solid lines in FIGS. **1**, **6** and **8** to a second or compressed position as shown in broken lines in FIG. **1** and in solid lines in FIG. **9** when the pad member **63** is pressed against an article **15**. When an article **15** is engaged, shoulder bolts **89** preferably slidably extend through apertures between the first and second sides of the second mounting plate **85** adjacent each corner thereof and are fixedly attached to the first mounting plate **73**. Coil springs **91** are provided about the shaft of each bolt **89** to normally urge the first and second mounting plates **73**, **85** to the first or separated position and for controlling the movement of the mounting plates **73**, **85** to the second or compressed position.

The transfer mechanism of the label transfer **59** may be of any specific type now apparent to those skilled in the art. Thus, for example, the transfer mechanism could consist simply of manual means for allowing movement of the label grip means **61** but preferably includes automatic means for moving the label grip means **61** from a first or home position to a second or label-pickup position for picking up a label **13** from the pickup point **34** at the label support means **27**, and then to a third or label-application position at the article **15**. Thus, the specific construction and operation of such automatic transfer mechanism may vary widely as will now be apparent to those skilled in the art from relatively simple rotation and extension structures based on hydraulic or pneumatic cylinders (see, e.g. Karp, U.S. Pat. No. 4,367,118, issued January 1983 and Treiber, U.S. Pat. No. 4,561,921, issued Dec. 31, 1985) to relatively complex robotic arms which allow movement to many different axes, etc., as will now be apparent to those skilled in the art.

The label applicator **11** preferably includes control means **93** for controlling the operation of the pressure source **55** and the vacuum source **77**, etc. The control means **93** may include a microprocessor. The label applicator **11** preferably includes a conveyor sensor **95** for determining when a printed label **13** is at the pickup point **34** and a pad sensor **97** for determining when the first and second mounting plates **73**, **85** are in the second or compressed position. The conveyor sensor **95** may include a typical photo eye including an Omron E32-DC200 fiber optic cable and an Omron E3XR-CE4T sensor power supply for producing a signal when a label **13** reaches the pickup point **34**.

The signal produced by the conveyor sensor means **95** may be used by the control means **93** to stop the label printer **17** and electric motor **41**, to cause the transfer mechanism to move the label grip means **61** to the second or label-pickup position at the pickup point **34**, to start the vacuum source **77**, to start the pressure source **55**, and to cause the transfer mechanism to move the label grip means **61** with the label **13** secured thereto with its sticky side out to third or label-application position in a timed sequence, etc., whereby the label **13** will be grabbed and picked up by the label grip means **61** and subsequently pressed against the article **15** as will now be apparent to those skilled in the art.

Since the conveyor sensor **97** will continue to produce a signal in the event the label **13** is not picked up by the label grip means **61**, the control means **93** can be programmed or designed to repeat the pickup process and to produce a system malfunction signal if the label **13** is not picked-up after a certain number of attempts, etc. When the label **13** is picked-up from the pickup point **34**, the conveyor sensor means **95** produces a signal which may be used to start the label printer **17** and electric motor **41** so that a subsequent label **13** can be printed and conveyed to the pickup point **34** while the first label **13** is being applied to the article **15** to thereby provide a faster cycle time, etc. The pad sensor **97** may include typical photo eye including Omron E32-DC200 fiber optic cables and an Omron E3XR-CE4T sensor power supply for producing a signal when the first and second mounting plates **73**, **85** move to the second, compressed

position (i.e., when the pad member **63** presses a label **13** against an article **15**). The signal produced by the pad sensor **97** may be used by the control means **93** to stop the vacuum source **77** and to cause the transfer mechanism to move the label grip **61** back to the first or home position.

The sensitivity of the pad sensor means **97** is preferably adjustable to allow for a wide range of sensitivity settings. The sensitivity adjustment can be set to apply labels **13** to a very light or fragile article **15** without causing damage to the article **15**. Additional sensors may be associated with the control means **93** for indicating the presence of an article **15**, etc.

FIGS. **12–16** illustrate a second embodiment of the apparatus of the present invention designated generally by the numeral **100**. Label applicator apparatus **100** includes a machine frame **101** that can be supported with an underlying support **102** such as a machine shop floor, concrete base, table top or the like. The apparatus **100** can include a printer **103** which is a commercially available printer for printing in sequence pressure adhesive labels having a release backing and printed matter (for example bar code information) on the printed surface as with the first embodiment. Printer **103** discharges labels **13** from output port **106** in sequence to tray **104**. Tray **104** has a surface **105** that resists adhesion of the adhesive side of the label thereto.

In the second embodiment, tray **104** is constructed of an aluminum plate, for example, having a surface **105** that resists adhesive connection of the adhesive side of the label thereto. The surface **105** is preferably a "plasma coated" surface such as a nickel chrome-type "plasma coated" surface. Such coatings can be applied to aluminum by Plasma Coatings, Inc. of Waterbury, Conn. and Plasma Coatings of Tennessee, Inc. of Memphis, Tenn. Such plasma coatings are commercially available and described in more detail by the specification sheets that are published by Plasma Coatings, Inc. entitled "Specialty Coatings Series". Tray **104** includes a plurality of slots **107–109** that can respectively receive air flow (slots **107**, **108**) or an electric eye **109** for purposes of sensing when a label **13** has been applied to surface **105** of tray **104**.

In FIGS. **12–14**, a conveyor **113** such as a typical moving conveying belt is shown conveying a plurality of articles such as boxes **110**, **111** in the direction of arrows **112**.

With the present invention, labels can be applied to any vertical and/or horizontal surface of boxes **110**, **111** including the vertical front panels **110A**, **111A**, vertical rear panels **110B**, **111B**, or either of the vertical side panels of boxes **110**, **111** designated as **110C**, **111C** and **110D**, **111D**.

The application of labels to either side of boxes **110**, **111** (and additional boxes conveyed on conveyor **113**) is accomplished by moving the pad **133** into preferably three different planes.

In the first plane, the pad **133** can be rotated to a generally horizontal position for engaging the surface **105** when picking up a label. The second plane is shown in FIG. **13**, which is a vertical plane parallel to the side panels **110C**, **110D**, and **111C**, **111D** of boxes **110**, **111**. In FIG. **14**, the third plane is shown wherein the pad **133** is in a vertical plane that is parallel to the front panels **110A**, **111A**, and rear panels **110B**, **111B** of boxes **110**, **111**.

The pad **133** can move into multiple planes by virtue of a "flapper" arrangement formed by static plate **114**, hinge **115**, and pivoting plates **116**. Rotary actuator **125** can be used to rotate the pad **133** between vertical and horizontal positions.

In FIGS. **12–14**, static plate **114** is mounted to machine frame **101**. Hinge **115** forms a connection between static plate **114** and pivoting plate **116**. Pivoting plate **116** is generally rectangular as shown in FIG. **12**. Pivoting plate **116** carries lever arm **117**.

An extensible member **118** forms a connection between machine frame **101** and lever arm **117**. The extensible member **118** can be, for example, a pneumatic cylinder that includes cylinder **119** and pushrod **120**.

Attachment plate **121** forms a connection to lever arm **117**. A pinned connection **122** forms a connection between pushrod **120** and attachment plate **121**.

Arrow **123** in FIG. **13** schematically illustrates an extension of pushrod **120** relative to cylinder **119**. Curved arrow **124** in FIGS. **13** and **14** illustrates the movement of pivoting plate **116** between a first position (FIG. **13**) wherein the plate **116** abuts and is generally parallel to the static plate **114**. This places pad **133** generally parallel to the side panels **110C**, **111C** of boxes **110**, **111**.

In FIG. **14**, moving plate **116** has rotated about pivot **115** to a position which places pad **133** parallel to the front panels **110A**, **111A** of each box **110**, **111** being conveyed on conveyor **113**.

Moving plate **116** carries rotary actuator **125** and slide **127**. Rotary actuator **125** is a commercially available actuator such as a rack and pinion type, pneumatically controlled actuator. Actuator **125** includes a rotary shaft **126** that forms a connection to the fixed section **129** of slide **127**. The slide **127** includes a fixed section **129** and a sliding section **131**. The sliding section **131** has a first end **128** spaced away from pad **133** and a second end **130** adjacent pad **133**. Slide **127** can be a pneumatically operated slide that moves the sliding section **131** in the direction of arrows **132** between extended and retracted positions.

In FIGS. **13** and **14**, slide **131** is in the retracted position which places end **130** of slide **131** adjacent fixed section **129**. In order to apply a label **13** to side **110C** of box **110**, the apparatus **100** is oriented in the position shown in FIG. **13**. In this position, the extensible member **118** has extended its pushrod **120** in the direction of arrow **123** to align pivoting plate **116** with fixed plate **114**. The pneumatic slide actuator **127** is then operated to move the second end **130** away from fixed section **129** and in the direction of arrows **132** until the pad **133** engages side **110C** of box **110**.

In order to apply a label to a selected front panel **110A**, **111A**, or a selected rear panel **110B**, **111B** of a box **110**, **111**, a user positions the apparatus **100** in the position shown in FIG. **14**. In this position, the rotary actuator **125** can be used to position the pad **133** in the position shown in FIG. **14** for applying a label to the front panel **111A** of a box **111**. Alternatively, the pad **113** can be rotated one hundred eighty degrees (180°) with actuator **125** for applying a label to the rear **110B** of box **110**. In FIG. **14**, extensible member **118** has been operated to withdraw pushrod **120** as shown so that the moving or pivoting plate **116** has pivoted ninety degrees (90°) away from fixed plate **114** as shown by arrow **124**.

In order to pick up a label **13** from surface **105**, the pad **133** is rotated using the rotary actuator **125** from the vertical position shown in FIG. **12** ninety degrees (90°) until the pad **133** is in a horizontal position. The slide **127** is then operated to move the end **130** away from fixed section **129** of slide **127** until the pad **133** reaches the label **13** placed on tray surface **105**.

FIGS. **12** and **16** show a second embodiment of the pad, designated as **133** in the Figures. Pad **133** includes a rear mounting plate **134** and a front mounting plate **135** supported parallel to plate **134**. The front mounting plate **135** carries a label holding pad **136** that can be of foam, and

constructed in accordance with the first embodiment (FIGS. **6–11**), providing an array of openings thereon and a manifold for receiving vacuum via vacuum source **137**. However, the embodiment of FIGS. **12–16** adds a second vacuum source in the form of a suction cup **144**. The suction cup **144** receives its own vacuum source via vacuum line **143**. Suction cup **144** can be used to assist in the removal of a label **13** from its release liner when very large labels **13** are used or if the adhesive between the label and the release liner is a very aggressive adhesive.

The connection between plates **134, 135** can be as with respect to the preferred embodiment, using a plurality of telescoping connections using bolts **138** and coil springs **139** so that the plates **134, 135** can move together when an article **110, 111** is engaged. The telescoping bolt **138** and spring **139** arrangement can include bolts **138** having an enlarged head **140**. Bolts **138** are attached rigidly to plate **135** and pass through openings in plate **134**. The heads **140** are larger than the diameter of openings in plate **134** while the shank of each bolt **138** is slightly smaller than the openings in plate **134**. Coil springs **139** thus hold the plates apart in an extended position. However, when the label applicator pad **133** presses its label **13** against an article **110, 111**, pad **136** and mounting plate **135** compress toward the plate **134** to define a collapsed or retracted position.

Sensors **141, 142** can be used to determine when such a collapsing of the plates **134, 135** together has occurred thus sensing that a label **13** has been applied to the desired article, such as boxes **110** or **111**. As with the preferred embodiment of FIGS. **1–11**, such a sensing can be used to then reverse direction of the pad **133** for returning it to the label pickup point at surface **105**.

Air jets **162** can be used to transmit air through slots **107, 108** to the underside **21** (adhesive side) of label **13**. This air flow is a controlled air flow as shown by the arrows **163** in FIG. **16**. The air flow **163** is relatively small, sufficient to provide a thin layer of air between the surface **105** and the adhesive surface **21** of label **13**, thus preventing an aggressive adhesive connection being formed between label **13** and tray **104**.

In FIGS. **17–20**, a third embodiment of the label applicator pad portion of the apparatus of the present invention is shown, designated by the numeral **145**. In FIGS. **17–20**, label applicator pad **145** includes a rear mounting plate **146**, a front mounting plate **147**, and a label holding pad **148** such as foam pad that is affixed to the plate **147** as with the preferred embodiment. The plate **147** and pad **148** can be constructed as with the preferred embodiment of FIGS. **6–11**, having a plurality or array of openings **160** thereon and a manifold that communicates with vacuum source **149** for supplying vacuum to the openings **161**.

The embodiment of FIGS. **17–20** provides an improvement that assists in the complete application of a label **13** to an irregularly shaped article such as a cylindrical can **156**, for example, as shown in FIG. **18**. In FIG. **17**, arrows **150** indicate a holding of label **13** to pad **148** with the vacuum source **149**. A plurality of conduits **151–153** provide pressurized air to a plurality of air jets **157–159** respectively. The air jets **157–159** are activated at the same time that the vacuum source **149** is deactivated, namely when a label is to be discharged from the pad **148** to the article **146**.

As shown in FIG. **18**, when the vacuum **149** has been deactivated, air is transmitted under pressure via conduits **151–153**, schematically indicated by the arrows **154**. Arrows **155** schematically indicate the flow of pressurized air through air jets **157–159** and to the printed side **19** of label **13**. This ensures a force of pressurized air against the printed side **19** of the label **13** for wrapping the label around articles such as curved or cylindrical articles **156**, as shown in FIG. **18**.

As with the preferred and second embodiment, telescoping bolt **158** and spring **159** assemblies arrangements **160** can be used for forming a connection between the plates **146–147**.

FIGS. **21** and **22** show a fourth embodiment of the present invention, a multiple-position label applicator **200**, including means for varying the location of a label **213** on a product or article **210**, when the product or article is presented at a given location on a conveyer path.

Applicator **200** is designed to pick up labels **213** and place them in a precise, programmed location on a product **210**. Applicator **200** can place labels **213** on products within 0.010 inch of a predetermined location with a repeatability of 0.010 inch.

Programmable robotic label applicator apparatus **200** includes a mounting frame **201**, a printer or printers **217**, a label applicator pad **145** (as in FIGS. **17–20**, though one of the other applicator pads of the present invention could be used), and means for moving and controlling the label applicator pad **145**. The means for moving and controlling the label applicator pad **145** include an X slide **265**, a Y slide **266**, a vertical slide **267**, a rotary actuator **225**, and a computer system for controlling movement of the X slide **265**, the Y slide **266**, the vertical slide **267**, and the rotary actuator **225**. The computer system includes a means for programming and operating the computer system which preferably includes a touch screen **275** for ease of operation.

Apparatus **200** also includes a product handling system which includes a label station **274**, a finished product station **273**, and a means for transferring products **210** to the label station **274**, a shuttle means for transferring products **210** from the label station **274** to the finished product station **273**, and a means for transferring products **210** from the finished product station to a packaging area or other further handling area.

The label station **274** includes a tray **272** for unlabeled products which is mounted on a vertical lift **269** for unlabeled products. The finished product station **273** includes a tray **271** for labeled products which is mounted on a vertical lift **268** for labeled products.

The shuttle means for transferring products **210** from the label station **274** to the finished product station **273** can include a suction pad **245** for labeled products, a vertical shuttle **282** for labeled products attached to suction pad **245**, and a horizontal shuttle **281** for labeled products attached to vertical shuttle **282**. Preferably, there is a vacuum actuated switch (not shown) which automatically causes cylinder **282** to rise vertically when a vacuum sufficient to raise labeled product **210** is sensed by the vacuum actuated switch.

A verification means in the form of a scanner **285** for reading bar-code labels is preferably present to confirm proper placement of a label **213** on a product **210** by scanning a bar-code on the label **213** after the label has been placed on the product **210**. A good reading means that the label has been accurately and properly placed and is readable, and a signal is then sent to the shuttle means to transfer the product **210** from the label station **274** to the finished product station **273**. If there is a bad reading, the apparatus can automatically be shut down and an alarm sounded to alert the operator of a problem, or some other event can be programmed to occur, such as a rejection of the product **210** for which there is a bad reading.

The applicator **200** is designed to pick up small labels **213** from either a printer or printers **217** or label dispensers (not shown). The printers **217** or dispensers will present labels **213** in exactly the same location every time. The applicator **200** has the ability to pick up small labels **213** at multiple locations when dispensed from the printer **217** or dispenser. When the printer **217** is an Intermec 3240 printer, labels **213** may be as small as 0.125" in width across the front of the printer or dispenser by 0.5" long or as large as up to 4" wide by 6" long. The label **213** may be presented from a single label **213** to multiple labels **213** across the face of the printer **217** or dispenser. Label lengths may vary out of the printer **217** or dispenser.

Once a label **213** is picked up by the vacuum pad **145** the applicator **200** can be programmed to move to multiple locations. These locations can be in the X reach, Y, and rotated positions. The label placement preferably repeats within 0.01 inches. The ability to rotate the label **213** allows the printer **217** or dispenser to be placed in the same location and the label **213** to be moved and rotated to multiple positions.

The applicator **200** is preferably supplied with a touch screen **275**, such as an OMRON NT SERIES, for programming and information displays. The touch screen program works by moving the pad **145** to the location where the label **213** is to be picked up or placed. The speed and acceleration desired from point to point can be programmed for each step by the operator in the field or they can be pre-programmed. In each step inputs and outputs can be programmed along with timing functions for each step. A "Next Step Motion Controller", commercially available from Sloan Fluid Accessories of Nashville, Tenn., can be used to interact with the touch screen **275** to control the X and Y positioning of the vacuum pad **145** during label pickup and label application, as will be described further. The Next Step Motion Controller Operations Manual, Software V2.00, published by Sloan Fluid Accessories of Nashville, Tenn., is incorporated herein by reference. The manual contains information about how to use the "Next Step Motion Controller" to interact with the touch screen **275** to control X and Y positioning.

One can use the touch screen **275** to position the vacuum pad **145** over the first label **213** to be picked up from the printer **217** or dispenser. One can use the X reach and Y shuttle keys to move the pad **145** in the X reach and Y shuttle directions. Once the pad **145** is in the correct position, the display of the touch screen **275** will indicate the coordinates of the X reach and Y shuttle. The operator then presses a save button to program the position into memory. The operator can then press the "X reach" spot on the touch screen **275** to adjust the acceleration and velocity of the "X reach" axis for this location. The operator can then press the "Y" spot on the touch screen **275** to adjust the acceleration and velocity of the "Y" axis for this location. Velocity can be, for example, from 0.1 inches per second up to 10 inches per second, or even up to 25 inches per second. Acceleration can be, for example, from 0.00 up to 5 inches per second.

Outputs can be programmed through the touch screen **275** by pressing an output button on the touch screen **275**, which is used on every step. Once the output screen is displayed, the operator presses a button to turn on the output for the step in which the operator is. Outputs must be programmed in each step where the output is required to be on.

Inputs are preferably programmed through the touch screen **275**, by pressing the input button on the touch screen **275**, which is used on every step. Once the input screen is displayed, the operator presses a button to turn on the input for the step in which the operator is. Inputs must be programmed in each step where the input is required to be on.

A rotary actuator **225** is used to rotate the label from zero to 180 degrees. The rotary actuator **225** can use a set point module to set up to 4 separate degrees of rotation. The preset locations can be called up in the touch screen program when they are required. The 4 set points are field changeable. However, in some cases, it is preferable to have a rotary actuator which can simply move the label 90 degrees, and use a printer (such as the Intermec 3240) which has the capability of printing labels right side up or upside down. In this manner, the labels **213** can be presented in four different orientations with relatively simple apparatus and relatively simple programming.

If one chooses to use a rotary actuator having several set points, then one must set the set point module on the rotary actuator **225**. In order to do so, the operator of apparatus **200** rotates the rotary actuator **225** (which can be air actuated) to the first position required. With a small screw driver, he can turn the number one set point, until the light indicating number one turns on. The procedure can then be repeated for the next three steps to set all four set points. Not all set points have to be used. The rotary actuator can advantageously have two positive stop locations that are adjustable from zero to 180 degrees.

The pad **145** is the preferably the touch sensitive pad of FIGS. **17–20**, though it could comprise any of the pads disclosed herein. Once the X and the Y coordinates of the upper left-hand corner of the label **213** (or any fixed point of the label **213**) have been positioned, the pad **145** extends to the product **210**. Once the product **210** is touched, the sensors **141**, **142** on the pad signal the vacuum to drop, applying the label **213** and retracting the pad **145**. A light touch is set so as not to damage the products **210**.

Multiple programs can be programmed and stored for recall at any time.

The controlling computer can advantageously include an Omron PLC, which allows for multiple programs to be stored once they are programmed. The touch screen **275** is one option used to call up programs previously saved.

A thumb wheel, such as thumb wheel model no. T-55, commercially available from Cherry, is also an option which can be used in place of the touch screen **275**, to call up saved programs.

While it is preferable to have a touch screen **275** which includes multiple displays to guide a user through programming and use of the apparatus **200**, touch screen **275** could be omitted and apparatus **200** could simply include means for receiving an input of X and Y coordinates of where the label **213** will be presented by the printer **217** and an input of X and Y coordinates of where the label **213** will be placed on the product **210**, with all of the information about vacuum operation for pad **145** and up and down motion of pad **145** being pre-programmed into apparatus **200**.

Menu screens appearing on touch screen **275** can be used to recall programs.

Optionally, an "Auto/Manual/Setup" screen can displayed on start-up. By pressing "Auto", one will start the operation of applicator **200** and generate a screen which displays the position of the X and Y axis in 100ths of an inch. The inputs and outputs optionally flash in each sequence. The top of the screen can display counts, which is the number of cycles.

A "Setup" screen can optionally be used to pick a program to be used. This display can optionally also allow program-

ming of all functions. Inputs can be the sensors **141**, **142**, and other external devices sending signals.

Outputs can be to the valves controlling the vacuum and air supply, and to the motors controlling the X and Y positioning of the pad **145**.

The base unit speed of the pad **145** in the X and Y directions can be up to 10 inches per second, or even up to 25 inches per second.

The acceleration and deceleration rates of the pad **145** in the X and Y directions can be set. The desired coordinates for the pad **145** can be typed in for the X and Y axes in 100ths of an inch.

In the general setup mode of the software which can be used to control apparatus **200**, program choices can be made and a password (if any) can be entered.

Apparatus **200** is preferably so sensitive and precise that a label 0.25" by 0.50" can be picked up without distributing the other labels of similar size presented side-by-side by the printer **217**.

Labels **213** can presented by means of a printer **217** or a dispenser. In either event, it is preferable for them to be presented with the backing stripped and a small portion (e.g., a strip 1/16" long and as wide as the label **213**) of the label **213** remaining on the backing. Leaving a small portion of the label **213** on the backing keeps the label **213** in the proper and consistent position for pick up. This position is critical in the operation of the applicator **200**. If the label **213** is not picked up in the same position every time, the placement position will vary. The labels **213** rest on the tray **104**, after they are stripped with the adhesive or glue side toward the tray **104**. The label or labels **213** may vary in size both in length and in width across the face. The labels **213** may also be presented as multiples across the face. Multiple Omron Fiber optics are used to sense the presence of each label **213**. The touch screen **275** can be used to program the inputs from the Omron Fiber optics. The inputs can be programmed depending on the number of labels to be sensed.

The touch screen **275** can be used to position the pad **145** over the first label **213** to be picked up by using the X reach inputs to position the X slide (to keep costs down, preferably a BCES100 Series Tolomatic slide with stepper motor, though a Baldor brand servo could advantageously be used when cost is not a factor) and the Y inputs to position the Y slide (as with the X slide, preferably a BCES100 Series Tolomatic slide with stepper motor, though a Baldor brand servo could advantageously be used when cost is not a factor) over the first label **213**. Manual input of the X and Y coordinates (and of all other actions) can be done as follows. The first step is label pick-up (Step "**00**" is the home position).

The pad **145** is positioned over the label **213** to be picked up. Using input arrows on the touch screen **275**, one can move the pad **145** around until it is in the proper location to apply a label **213**. One then presses a save button to save the X and Y coordinates (which can optionally be displayed on the screen **275** in increments of 100th of an inch).

One can then press the "output" button to change the screen to the output screen. One can then press the appropriate button to highlight the output required for this step. In this step the output is for the vertical slide **267** (preferably a slide commercially available from PHD as a PHD SA03 Series slide) to retract, for the rotary actuator **225** (preferably a rotary actuator commercially available from PHD as model no. RAS25 Series 90 Degree Rotation) to move back to the home position, and for the vacuum pump (preferably manufactured by Gast) to be off. One enters a time in 1/10th of a second that the power to the output should remain on. One then exits back to previous screen.

One then presses the "input" button on the touch screen **275** and enters the number of the inputs required for this sequence. The input from the label detector (such as, for example, an Omron Fiber optic, model no. E3X-A11, not shown in FIGS. **21** and **22**, but present adjacent tray **104**) to indicate that a label **213** is present on the tray **104** should be one of the inputs. On the touch screen **275** one can press the "down" arrow to move to step "**01**". One can reprogram the same X and Y positions for this step. One can press the "out" button on the touch screen **275** to change the screen to display the available outputs, which start with output number "**0**". One can press the appropriate button to enter the output to extend the vertical slide **267** to the tray **104**. On the same screen one presses the appropriate output to turn on the vacuum to the pad. On the same screen one presses the "output" button to turn on the appropriate button to rotate the rotary actuator **225** to the home position (if it was not done in the first programming step). One then presses the "exit" button to go back to the screen with step number "**01**". One then enters a time in 1/10th of a second that the power to the outputs should remain on.

One then presses the "input" button and enter the number of the inputs required for this sequence. The input from the label detector (such as an Omron Fiber optic, model no. E3X-A11) to indicate that a label **213** is present should be one of the inputs.

One then can arrow down to move to step number "**02**". One programs the same X and Y coordinates as before and saves them. One then presses the appropriate "output" button to retract the vertical slide **267**. One also presses the appropriate button to keep the vacuum on to hold the label **213**. One also presses the appropriate button to keep the rotary actuator **225** in the home position. One then enters a time in 1/10th of a second that the power to the output should remain on. One then exits back to the previous screen.

One next presses the "input" button and enters the number of the inputs required for this sequence.

Step "**03**": by using the X and Y arrows, one positions the pad **145** over the location where pad **145** is to place the label **213**. One follows the above procedures for saving the location of the X and Y coordinates on the screen.

One next enters the appropriate outputs to retract the vertical slide **267**, keep the vacuum on to hold the label **213**, and to keep the rotary actuator **225** in the home position. One then enters the time period that the outputs should remain on in this step.

Step "**04**": One programs the same coordinates as in step "**03**" to allow the label **213** to be placed. The rotation is an option at this location. One can press the button to rotate the rotary actuator **225** to the desired position, home or any angle up to 180 degrees. Once can press the output button to keep the vacuum on to hold the label **213**. One presses the appropriate button to extend the vertical slide **267** down toward the object to be labeled. The input should indicate that the part is in place to be labeled (this can be determined by an Omron Fiber optic, model no. E3X-A11). This is the location and position where the label is applied to the surface of the product **210**.

Step "**05**": one presses the "output" button to turn off the vacuum to release the label **213**. One presses the appropriate button to keep the rotary actuator **225** in the same position used when extending. One presses the "input" button <<pad sensor>> for the touch sensor. This input will cause a reversal of the direction of the vertical slide by using the input from sensors **141**, **142** of the touch sensitive pad **145**.

In Step "**06**", one presses the "output" button to retract the vertical slide and the button to keep the rotary actuator **225** in the same position as in the previous step. One then enters the time required for the outputs to be on in this step.

Preferably, all information about movement and operation of the pad **145** from the label output location of the printer **217** to the label application location and back again after applying the label is preferably pre-programmed into apparatus **200** so that an operator need only program in the X and Y coordinates of the top left edge of the label as it is presented by the printer **217** and the top left edge of the label as it is to be applied to the product **210**, and the desired orientation of the label on the product **210** (which preferably is simply right-side up, upside down, top at left, or top at right).

Additional steps can be programmed into apparatus **200**, such as a shut-down of movement of pad **145** if the scanner **285** does not detect the label **213** after label **213** is applied to the product **210**. A bad read could be caused by the absence of a label **213** or the presence of a poorly printed label **213**.

After all programming has been completed, apparatus **200** can operate as follows to label products.

A printer or printers **217** (two shown in FIGS. **21** and **22** appropriate means can be included for instructing the pad **145** to go to one printer or the other) presents a label **213** or labels **213** on a tray (not shown in FIGS. **21** and **22**) such as tray **104** (and positioned adjacent printers **217** as tray **104** is positioned adjacent printer **117** in FIG. **12**), with preferably a portion of the label or labels **213** still attached to the backing of the labels to ensure positive positioning of the labels **213** until they are picked up by pad **145**. The X slide **265** and the Y slide **266** move pad **145** laterally over the label **213** to be picked up, then the vertical slide **267** moves pad **145** downward until it contacts label **213**, at which point the sensors **141**, **142** cause pad **145** to begin the vacuum to pick up the label **213** and to cause vertical slide **267** to retract (for more details on this see the description of FIGS. **12–20**). The rotary actuator **25** at some point causes a rotation of pad **145** prior to placing of the label **213** on the article **210** (if the apparatus **200** has been programmed to do so). The X slide **265** and the Y slide **266** move the pad **145**, with the label attached thereto by the vacuum, laterally over the product **210** above the desired location of placement of the label **213**. Next, the vertical slide **267** moves pad **145** downward until it contacts the product **210** on tray **272** and receives a predetermined amount of resistance to further downward movement, at which point the sensors **141**, **142** cause the pad **145** to stop the vacuum and to thus leave the label **213** and to cause vertical slide **267** to retract (for more details on this see the description of FIGS. **12–20**). The pad **145** can then move to the home position and be ready to pick up another label **213**.

Once product **210** is labeled, if label **213** includes a bar-code, optional scanner **285** can be energized to read the bar code on label **213**. If the optional optical scanner **285** successfully reads the bar code on the label **213**, then pad **245** is actuated to move over the labeled product **210** on horizontal cylinder **281**, and move downward to the labeled product **210** on the vertical cylinder **282**. Downward movement of the pad **245** is checked by the part to be picked up. A vacuum is applied to pick up the labeled product **210**. The suction pad **245** for labeled products **210** preferably has a vacuum actuated switch which causes cylinder **282** to rise vertically when a vacuum sufficient to raise labeled product **210** is sensed by the vacuum actuated switch. Pad **245** is then moved back horizontally on cylinder **281** until the labeled product **210** is positioned over the tray **271**, at which time the pad **245** is lowered and the vacuum supply to the pad **245** is cut off, causing the labeled product **210** to rest on the tray **271** (or on other labeled products **210** themselves resting on one another or tray **271**). Some appropriate means can transfer labeled products **210** to a packaging or other further processing area from area **273**.

The following table lists the parts numbers and parts descriptions as used herein and in the drawings attached hereto.

PARTS LIST

Part Number	Description
11	label applicator apparatus
13	pressure sensitive label
15	article
17	label printer
19	first side
21	second side
23	adhes ive
25	output port
27	label support
29	belt
31	sheave
33	axles
35	body member
37	ear
38	slot
39	motor drive
41	electrical motor
43	arrow
45	drive belt
47	first pulley
48	drive shaft
49	second pulley
51	pressure source
53	air jets
55	pump
57	tubing
59	label transfer
61	label grip
63	resilient pad
65	first side
67	second side
69	operative
71	manifold
73	first mounting plate
75	port
77	vacuum source
79	pipe
81	first side
83	second side
85	second mounting plate
87	actuator arm
89	shoulder belt
91	coil spring
93	control means
95	conveyor sensor
97	pad sensor
100	label applicator apparatus
101	machine frame
102	underlying support
103	printer
104	tray
105	plasma coated surface
106	output port
107	slot
108	slot
109	slot
110	box
110A	front panel
110B	rear panel

-continued

PARTS LIST

Part Number	Description
110C	side panel
110D	Side panel
111	box
111A	front panel
111B	rear panel
111C	side panel
111D	side panel
112	arrow
113	moving conveyor belt
114	static plate
115	hinge
116	pivoting plate
117	lever arm
118	extensible member
119	cylinder
120	pushrod
121	attachment plate
122	pinned connection
123	arrow
124	curved arrow
125	rotary actuator
126	rotary shaft
127	slide
128	first end
129	fixed section
130	second end
131	sliding section
132	arrows
133	label applicator pad
134	rear mounting plate
135	front mounting plate
136	label holding pad
137	vacuum source (preferably connected to a vacuum generator such as a GAST vacuum generator, model no. VG-015-000)
138	telescoping bolt
139	coil spring
140	head
141	sensor
142	sensor
143	vacuum line
144	suction cup
145	label applicator pad
146	rear mounting plate
147	front mounting plate
148	label holding pad
150	arrow
151	conduit
152	conduit
153	conduit
154	arrow
155	arrow
156	cylindrical object
157	air jet
158	air jet
159	air jet
160	telescoping bolt
161	vacuum openings
162	air jets
163	arrows
200	programmable robotic label applicator apparatus
201	mounting frame
213	label
217	printer (e.g., an Intermec 3240 printer or an Intermec 3440 printer)
225	rotary actuator (preferably a rotary actuator commercially available from PHD as model no. RAS25 Series 90 Degree Rotation)
245	suction pad for labeled products (preferably has a vacuum actuated switch which causes cylinder 282 to rise vertically when a vacuum sufficient to raise labeled product 210 is sensed by the vacuum actuated switch)
265	X slide (e.g., a Tolomatic brand slide, model no. BCES100)
266	Y slide (e.g., a Tolomatic brand slide, model no. BCES100)
267	vertical slide (e.g., PHD slide, SA03 series)
268	vertical lift for labeled products (e.g., Lintra cylinder, part no. C/46-50/14/L3)
269	vertical lift for unlabeled products (e.g., Lintra cylinder, part no. C/46-50/14/L3)
271	tray for labeled products
272	tray for unlabeled products
273	finished product station
274	label station
275	touch screen
281	horizontal shuttle for labeled products (e.g., Lintra cylinder, part no. C/46-50/14/18/M)
282	vertical shuttle for labeled products (e.g., PHD slide, SA03 series)
285	scanner for reading bar-code labels (such as an Intermec 2830 control box with an Intermec 2852 head)

Because many varying and different embodiments may be made within the scope of the inventive concept herein taught, and because many modifications may be made in the embodiments herein detailed in accordance with the descriptive requirement of the law, it is to be understood that the details herein are to be interpreted as illustrative and not in a limiting sense.

What is claimed as invention is:

1. An apparatus for transferring a series of labels each with opposing adhesive and printed sides to discrete locations on a preselected surface of each of a plurality of articles being conveyed along a conveyer path, comprising:

a) a printer for printing in sequence a plurality of pressure sensitive adhesive labels, each label having an adhesive side and a printed side with printed matter thereon, each of the labels having a release liner backing on the adhesive side, the printer having means for striping at least a portion of the backing from the labels as they are printed;

b) an output port on the printer for discharging labels in sequence as each label has been printed, and after at least a portion of its backing has been stripped;

c) label transfer means for transferring labels from the output port to a pickup point, the transfer means including a transfer surface with means thereon for contacting without substantial adhesion thereto, the adhesive side of the label;

d) label pickup pad means that includes a label holding pad with a pad surface for lifting a label free from contact with the pickup point by engaging the printed side of the label;

e) vacuum means for applying a vacuum to the pad surface when the label holding the pad is positioned to receive a label from the label transfer means, the label holding pad being moveably supported by the frame to move sequentially between the pickup point and the articles as the articles are conveyed along the conveyer path;

i) control means for controlling the timing of the transfer of labels from the printer to the pickup point and the travel of the pad between the pickup point and each of the conveyed articles;

g) computer means for controlling said apparatus for moving said label holding pad between the pickup point and the articles, said computer being programmable to control said apparatus to a selected horizontal or vertical side of the article upon which the label is to be affixed; and

(h) means for applying the labels on the articles at a location, including means for varying the location on the articles at which the labels are applied by programming location coordinates into a computer controlling the apparatus for moving said label holding pad between the pickup point and the articles, said computer being programmable to control said apparatus to pre-programmed X and Y coordinates of the surface of the article upon which the label is to be affixed.

2. The apparatus of claim **1** wherein said pickup pad means comprises:

(i) a moving pickup pad member that includes a pair of spaced apart mounting plates that are movable relative to one another between extended and retracted positions, said plates being supported at a desired known fixed distance apart in said extended position, one of the plates carrying said label holding pad;

(ii) a plurality of openings spaced over the surface of the label holding pad;

(iii) spacer means for holding the mounting plates apart said fixed distance, said spacer means allowing the plates to move toward one another responsive to compression applied to one of said mounting plates such as when the label holding pad member applies a label to one of the articles when a label has been deposited on the tray; and

(iv) spring means for urging the plates into said extended position.

3. The apparatus of claim **2** further comprising sensor means for indicating when the plates are compressed together.

4. The apparatus of claim **2** wherein the spacer means comprises a plurality of telescoping posts extending between the plates.

5. The apparatus of claim **2** wherein the printer has means for stripping at least a portion of the release liner backing from the label prior to a discharge of the label from the printer.

6. The apparatus of claim **2** wherein the label applicator means includes a sensor that enables the applicator means to reverse directions upon contacting one of the objects to be labeled.

7. The apparatus of claim **2** wherein the label applicator means includes touch sensitive means for halting movement of the applicator means when it contacts one of the objects to be labeled.

8. The apparatus of claim **2** wherein the label applicator has a resilient pad surface with an array of openings on its pad surface and the vacuum source communicates with the array of openings.

9. The apparatus of claim **8** further comprising a suction cup on the pad surface spaced from the array of openings.

10. The apparatus of claim **1** wherein the control means includes sensors for determining when a printed label is at the pickup point.

11. The apparatus of claim **1** wherein the control means includes sensors that return the label applicator to the pickup point when a printed label has been placed at the pickup point.

12. The apparatus of claim **2** wherein the control means includes sensors that determine when the label has been pressed against the article by the label applicator, and responsive thereto, moves the label applicator away from the article.

13. A label applicator apparatus for applying printed labels having an adhesive backing at a discrete location on an article surface to each of a stream of articles being conveyed along a path, comprising:

a) printer means for printing a stream of successive printed labels, each label having a printed side and an adhesive side;

b) transfer means for sequentially positioning each label adjacent the printer means;

c) a machine frame positioned adjacent the printer means;

d) a label pickup pad that is moveably supported by the frame between a first pickup position and multiple selected applicator positions;

e) the combination of the printer means and the transfer means defining means for positioning the label with the adhesive surface facing the label pickup pad when the pickup pad is in the first pickup position;

f) the pad having means for sensing when the pad and an attached label have engaged an article;

g) control means for moving said label holding pad between the pickup point and a selected horizontal or vertical side of the article upon which the label is to be affixed, the selected horizontal or vertical sides being programmable into the control means via a computer; and

h) control means for moving the pad between the pickup position and the multiple applicator positions, the multiple applicator positions being programmable into the control means in relation to selected X and Y coordinates of the surface of the article via a computer.

14. The label applicator apparatus of claim **13** further comprising blow-off means carried by the pad for aiding in a transfer of the label from the label pickup pad to one of the articles being conveyed, said blow-off means including at least one air jet for discharging air between the label and the label pickup pad.

15. The label applicator apparatus of claim **13** further comprising air jet means associated with the transfer means for forming a layer of air in between the label and transfer means after the label has been discharged from the printer and before the label has been picked up by the label pickup pad.

16. A method of applying a printed label to discrete locations on a preselected surface of each article in a stream of conveyed articles traveling on a conveyor path comprising the steps of:

a) generating a plurality of labels with a label printer, each label having an adhesive face;

b) printing printed matter on a face of the label opposite the adhesive face;

c) discharging labels in sequence from an output port of the printer after printing the label with the printer;

d) placing each label that is discharged from the output port on a transfer surface at a pickup point, wherein the label adhesive surface faces the transfer surface when the label is on the transfer surface;

e) picking up the label from the pickup point with a moving label applicator that moves between the pickup point and a label application position spaced away from the pickup point and wherein the label applicator has a pickup pad with a pad surface that is generally sized and shaped to conform to the size and shape of the label;

f) using a source of vacuum associated with the label applicator to hold the printed side of the label to the label applicator so that the adhesive side of the label does not adhere to the label applicator;

g) moving the label applicator and the label picked up to a position adjacent a selected horizontal or vertical side of one of a series of articles to be labeled and traveling on the conveyor path;

h) selectively applying the label to a selected location on the article corresponding to the X and Y coordinates of the article surface to which the label is to be applied, the selected location being selectable by programming said location X and Y coordinates into a computer controlling movement of the pad surface by contacting the article with the label applicator and the adhesive side of the label by engaging the article with the pad surface; and

i) returning the pad surface of the label applicator to the pickup point when the next label is transferred from the printer output port to the pickup position.

17. The method of claim **16** wherein each label has a release liner covering the adhesive face and in step "c" at least a portion of the release liner is stripped away before the label is discharged from the output port.

18. The method of claim **16** further comprising the step between steps "h" and "i" of initiating a return of the label applicator by compressing the label applicator upon engagement of the article.

19. The method of claim **16** wherein step "a" comprises the step of generating a plurality of labels in sequence, each with a printed surface, an opposed adhesive surface and a release liner covering the adhesive surface.

20. The method of claim **19** further comprising the step between steps "c" and "d" of stripping at least a portion of the release liner from the adhesive side of the liner.

21. The method of claim **16** further comprising the step of blowing air against the adhesive side of the label after the label is placed on the transfer surface.

22. The method of claim **16** further comprising the step of blowing air against the printed side of the label as the label is applied to each article.

23. The method of claim **16** further comprising the step of determining with a sensor when the transfer surface has a label.

24. A method of applying a printed label having an adhesive surface on an adhesive side and having a printed side to discrete locations on a preselected surface of each article in a stream of conveyed articles traveling on a moving conveyor along a conveyor path comprising the steps of:

a) placing each label in sequence on a transfer surface that has a pickup point, wherein the label adhesive surface faces the transfer surface;

b) picking up the label from the pickup point with a moving label applicator that moves between the pickup point and a label application position spaced away form the pickup point and wherein the label applicator has a pickup pad with a pickup surface that is generally sized and shaped to conform to the side and shape of the label;

c) using a source of vacuum associated with the label applicator to hold the printed side of the label to the label applicator so that the adhesive side of the label does not adhere to the label applicator;

d) moving the label applicator and the label picked up to a position adjacent a selected horizontal or vertical side of one of a series of articles to be labeled and traveling on the moving conveyor;

e) selectively applying the label to a selected location on the article corresponding to the X and Y coordinates of the article surface to which the label is to be applied, the selected location being selectable by programming location coordinates into a computer controlling movement on the pickup surface by contacting the article with the label applicator and the adhesive side of the label by engaging the article with the pickup surface of the pad; and

f) returning the pickup surface of the label applicator to the pickup point when the next label is transferred from the printer output port to the pickup position.

25. The method of claim **24** further comprising the step generating a plurality of printed labels in sequence, each with a printed surface that includes a bar code and an opposed adhesive surface.

* * * * *